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1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, D.Sc., B.E.

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CALCAREOUS SPONGES

BY

PROFESSOR ARTHUR DENDY, D.Sc., F.R.S.,
UNIVERSITY OF LONDON.

WITH ONE PLATE.

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CONTENTS.

CALCAREOUS SPONGES.

By Arthur Dendy, D.Sc., F.R.S., Professor of Zoology in the University of London
(King's College.)

(With plate I).

The number of calcareous sponges in the collection is remarkably small, and of these the most conspicuous are a number of specimens of *Leucosolenia ventricosa*, obtained off Tasmania, while a large proportion of the remainder were collected on the shore at Macquarie Island, leaving very few which are really Antarctic. There is nothing strikingly novel in the collection, but three of the species have to be described as new. The classification adopted is that of Dendy and Row's "Classification and Phylogeny of the Calcareous Sponges," &c. [1913]. The dates in square brackets refer to the literature list at the end. In accordance with my usual practice, the specimens are numbered so that they can be referred to individually, the Roman numerals being the numbers which I myself attached to the jars as received by me, and the Arabic numerals referring to the specimens in the jars in cases where there were more than one. R.N. stands for register number.

Leucosolenia botryoides (Ellis and Solander) var. macquariensis nov.

(Plate I, figs. 1, 6*a*–6*e*).

(For literature and synonymy of the species, *vide* Minchin [1905]).

There are in the collection four colonies, or fragments of colonies, of this sponge. The largest (fig. 1) is irregular in outline and measures about 27 mm. in length by 17 mm. in greatest breadth and 10 mm. in greatest thickness. The colonies are massive and have apparently been encrusting, with broad bases of attachment. Each consists of a close network of slender, contorted tubes, averaging about half a millimetre in diameter; forming a fairly compact mass, but with no pseudoderm. From the upper surface spring a few short oscular tubes of much greater width, which appear to be formed each by the junction of a number of the slender tubes. An oscular tube may give off a few blind diverticula from its lower portion, but these are in reality only parts of the basal network which have not yet anastomosed with one another or with the older portions. The oscular tubes are only about 2 mm. in length and they may be as much in diameter. The terminal vents have no fringe of projecting spicules and vary greatly in size. They are, of course, true oscula and not pseudoscular. The colour of the sponge in spirit is white.

The canal system is perfectly typical and requires no further description. The histological condition of the material makes it impossible to investigate satisfactorily

the position of the nuclei of the collared cells, which are in the long-drawn-out condition characteristic of asphyxiated calcarea (examined in R.N. *T* 10).

The skeleton arrangement and spiculation are very typical. The following description of the spicules is taken from R.N. *T* 11.

Spicules :—

(1) Triradiates (fig. 6*a*); with wide oral angle, frequently approaching 180°; rays approximately straight, fairly stout, fairly gradually and sharply pointed; paired rays commonly measuring about 0·098 by 0·009 mm. when fully grown; basal ray usually shorter to a varying extent and often more slender.

(2) Quadriradiates (figs. 6*b*, 6*c*); similar to the triradiates but with the addition of an apical ray, which is moderately well developed, fairly stout but not very long, sharply pointed and commonly gently curved.

(3) Oxea (figs. 6*d*, 6*e*). There is only one kind of oxeote or monaxon spicule present, though they vary considerably in size, some of them being small enough to be classed as "microxea." The spicule is considerably flattened and slightly curved in the plane of the flattening (fig. 6*d*). It is fairly gradually and sharply pointed at the proximal end, which is apt to be bent somewhat sharply to one side in a plane at right angles to the flattening (fig. 6*e*). The distal end is hastate, sharply marked off from the remainder of the spicule by a slight annular thickening situate at about one-twelfth of the length of the spicule from the extremity. A typical example measured about 0·14 by 0·006 mm. A smaller specimen measured 0·09 by 0·005 mm. The largest I have seen measured only 0·17 mm. in length.

These monaxon spicules exhibit marked differences in shape and refringency according to the position in which they are viewed. When lying on edge (fig. 6*e*) they are narrower and much more highly refringent, the outlines appearing thicker and blacker than when lying flat (fig. 6*d*).

Professor Minchin, in his very elaborate memoir on "The characters and synonymy of the British Species of Sponges of the genus Leucosolenia" [1905], has fallen into a very curious error with regard to these spicules, in which he has been followed by Jenkin [1908]. He says (*op. cit.*, p. 359): "A remarkable point with reference to the monaxons of *Leucosolenia*, which I have found to hold good, not only with regard to the species described in this memoir, but also for all other species that I have examined, is that the monaxons can be separated more or less easily into two varieties, distinguished by the fact that one kind appears very refringent, the other, by comparison, pale, under the microscope. The refringent monaxons are always scarcer than the pale ones, but their peculiar optical property makes it very easy to find them, especially under low powers (Zeiss, Oc. II, Obj. B). In form the two kinds of monaxons may not differ essentially, but the refringent ones always show certain characteristics which may be summed up by saying that they tend to be straighter, more slender, and sharper than the others, and their distal barb is less distinct or absent,"

&c. As regards refringency, he concludes "that the difference between the two types is due to a difference in the rotation of the axis of crystallization to the form of the spicule."

It seems almost incredible that so careful an observer as Professor Minchin should have fallen into so simple a trap. It never seems to have occurred to him that he was merely looking at the same spicule in two different positions. The mistake is just the same that Bowerbank made many years ago with regard to his "bi-dentate" and "tri-dentate anchorates," and is the more surprising in that the triradiates and quadriradiates of *Leucosolenia* show exactly the same difference in refringency according to whether they are viewed flat or edgewise, as do the monaxons.

To any one who has seen these monaxon spicules and performed the simple experiment of rolling one over under the microscope, as I have done, observing how the form and the refringency change according to the position of the spicule, it must seem hardly necessary to give further proof of the correctness of this explanation of the supposed existence of two kinds of monaxons in species of *Leucosolenia.* I would point out, however, that everything which Professor Minchin himself says on the subject supports this conclusion. Their occurrence in all species examined by him* is in itself extremely suggestive, so also is the fact that the "refringent" individuals are less numerous than the "pale" ones, for it is less likely that the spicule will lie on its edge than that it will lie flat. The differences in shape are also just such as would be expected. A precisely similar condition is seen in the microxea of *Leucetta macquariensis,* described in this report (*cf.* figs 8*c*, 8*d*), and in the oxea of *Grantia tenuis* also found in the collection.

Leucosolenia botryoides var. *macquariensis* approaches more nearly in its characters to *Leucosolenia variabilis* than to the typical European form of *L. botryoides* as described by Minchin (*op. cit.*), while perhaps differing from both in the very strong development of the basal network of tubes and the relative shortness and scarcity of the oscular tubes.

Minchin himself points out that the difference between *L. variabilis* and *L. botryoides* is "purely one of degree in every respect," and I prefer to follow those authorities who consider *L. variabilis* as a mere variety of *L. botryoides.* It is interesting to find a variety of this common European species in so remote a locality as the Macquarie Islands.

Register Nos., Locality, &c.—I. 10–13. Macquarie Island. Picked up on beaches after storm, West Coast.

LEUCOSOLENIA VENTRICOSA (*Carter*).

Clathrina ventricosa Carter [1886].
Leucosolenia ventricosa Dendy [1891].
Leucosolenia ventricosa Dendy and Row [1913].

Several specimens of this common and easily recognisable species occur in the collection. It is unnecessary to add anything to the full description which I gave in

* Although he himself points out this fact Minchin nevertheless actually gives the presence of the supposed two kinds of monaxæ as a diagnostic character of *Leucosolenia variablis.*

1891. The locality from which the specimens were obtained (off Tasmania) adds but little to our knowledge of the distribution of the species; which has hitherto been obtained, so far as I am aware, only in the neighbourhood of Port Phillip.

Register Nos., Locality, &c.—VII, 1, 2, &c., off Tasmania.

Leucosolenia *spp.*

There are in the collection a few very small, simple, tubular Leucosolenias which I refrain from naming, as the material is insufficient to enable me to make a satisfactory investigation. Two of them (R.N. II, 1, 2) were in a separate tube labelled "Calcareous sponges, C. Bay,*14–12–13, D. 45–50 fath." Another was attached to the surface of *Leucetta antarctica* (R.N. VI), from Station XII.

There were also small fragments of a branched, probably reticulate *Leucosolenia,* associated with the specimens of *Grantia cirrata* var. *auroræ* and *Grantia tenuis* from Station II (?).

Leucetta antarctica *n. sp.*

(Plate I, figs. 2, 7.)

The single specimen in the collection (fig. 2) is an irregularly turbinate sponge, broadest above, where there is a large, irregular depression (not shown in the figure), making the sponge almost cup-shaped, and narrowing below to a short stalk. The cup-shaped depression is probably not a normal character, and may be due to inhibition of growth by a mass of Polyzoa attached to the surface of the sponge in the middle of the hollow. There are several large, compound vents, each consisting of a shallow depression bounded by a thin, prominent margin, and bearing the numerous apertures of the exhalant canals lying close together in its floor. These vents lie on or near the broadly-rounded margin of the cup-shaped depression, two of them are shown in the figure, and at least two others are present. The margins of all are somewhat sunk beneath the general level of the surface. The surface is smooth and covered by a thin dermal membrane, pierced by numerous small inhalant pores arranged in close-set groups. The total height of the specimen is 50 mm., and the maximum breadth 55 mm. The colour in spirit is pale yellowish-brown, and the texture rather soft and compressible, but resilient.

The ectosome is very feebly developed, being represented by the thin dermal membrane, and there is a thin gastral cortex surrounding the principal exhalant canals.

The canal system is of the ordinary leuconoid type. The dermal pores lead direct into wide inhalant lacunæ, which penetrate deeply into the choansome, and there break up into smaller lacunæ between which the flagellate chambers are thickly scattered in the feebly-developed mesoglœa. The flagellate chambers are much distorted by

* Commonwealth Bay.

shrinkage, but they are evidently oval or subspherical in form and about 0·14 mm. in diameter. They have numerous prosopyles as usual. The exhalant lacunæ lead into wide, exhalant canals which converge to open side by side in the floor of the vents.

Histologically the specimen is so badly preserved that it is impossible to say anything definite about the position of the nuclei of the collared cells, but it seems safe to assume that it is basal.

The skeleton consists of regular or subregular triradiates, lying tangentially in the dermal and gastral membranes and irregularly scattered in the choanosome, but, in the latter case, in such a way that, as seen in sections, they tend to enclose hexagonal areas more or less free from spicules. The choansomal skeleton is not very dense. There appear to be no sagittal spicules round the margins of the vents.

Spicules :—

Regular or subregular triradiates (fig. 7), with approximately equal rays and angles. Rays straight, conical, rather long and slender, fairly sharply pointed, varying greatly in size up to about 0·36 by 0·035 mm., but such large ones are extremely rare.

This species might very well fall within the wide circle of forms embraced by Haeckel's *Leucetta primigenia,* but, as I have already pointed out [1913] in describing my *Leucetta pryiformis,* it is hardly possible to disentangle all these forms from one another. Moreover, none of them seemed to resemble *Leucetta antarctica* at all closely as regards external features, which are probably sufficiently characteristic to distinguish the species from any previously described.

Register No., Locality, &c.—VI, Station XII (Lat. S. 64° 32′, long. E. 97° 20′), 110 fathoms, 31st January, 1914.

LEUCETTA MACQUARIENSIS *n. sp.*

(Plate I, figs. 3*a*–3*d*, 8*a*–8*d*).

There are eleven specimens of this species, all from the beach at Macquarie Island. The characteristic external form is massive, cushion-shaped, with convex upper surface and flattened base (figs. 3*a*–3*c*). Large specimens tend to become cavernous by the enclosure of external spaces in the process of growth. The upper surface is thrown into a network of irregular ridges and valleys, like a miniature mountain range, the summits being represented by small mammiform projections each bearing a small vent. Usually these projections are but slightly prominent, but in R.N., V. 2 (fig. 3*d*), which differs considerably in appearance from the other specimens, they may attain a height of 8 mm. The vents range up to about 2 mm. in diameter, but are usually much smaller, and sometimes they are arranged in more or less definite rows. Their margins are usually naked, without conspicuous collar or fringe. When viewed under a pocket lens the surface of the sponge has a minutely granular appearance. The largest specimen (R.N. I. 1), which may be taken as the type, measures about 40 mm. in length by 25 mm. in breadth, and 20 mm. in height. The smallest (R.N. I, 9) measures

only 10 mm. in maximum diameter and has but a simple vent. The colour in spirit is dirty white; the texture firm and compact, albeit somewhat cavernous at times.

The canal system is leuconoid and quite typical. There is a rather thin and ill-defined ectosome, pierced above by the thickly scattered dermal pores and partially penetrated from below by the large, irregular sub-dermal cavities, if one may so term them. From the dermal pores short canals lead through the outer part of the ectosome into the sub-dermal cavities, many opening into each. The subdermal cavities pass down into the choanosome as large inhalant lacunæ, breaking up into smaller lacunæ as they go. The flagellate chambers are very thickly scattered through the choansome; they are oval or nearly spherical, and measure about 0·086 mm. in diameter. The exhalant lacunæ are similar to the inhalant, the principal ones leading into large oscular tubes which terminate at the vents. The oscular tubes are lined by a thin and rather ill-defined gastral cortex.

The main skeleton of the sponge, that of the choanosome or chamber layer, consists of thickly scattered triradiates arranged without any order. There is a well-defined dermal skeleton consisting of the following parts :—(1) In the outermost part of the ectosome a thin layer of triradiates arranged tangentially. (2) Again in the outermost part of the ectosome, a layer of microxea, arranged radially with slightly projecting outer ends. (These spicules appear to be almost, if not quite, absent in some specimens, though very numerous in the type). (3) Numerous, relatively large, more or less club-shaped oxea, arranged radially with the thick ends projecting from the surface and the thin ends penetrating through the ectosome and for a short distance into the choanosome. (4) Occasional bundles of very slender, hair-like trichoxea, arranged radially in the ectosome. (The extent to which these spicules are developed varies greatly in different specimens; in R.N. V, 1, they form fringes round the margins of the very minute vents, but this appears to be quite exceptional). The skeleton of the gastral cortex consists of a fairly thick layer of sagittal triradiates, with the paired rays turned towards the vent and much more strongly developed than the basal ray. Occasionally these spicules possess a short apical ray, the number of quadriradiates thus formed varying greatly in different specimens; they are very rare in the type, but numerous in R.N. V. 1.

Spicules :—

(1) Triradiates (fig. 8*a*); perhaps always more or less sagittal, with the oral angle wider than the paired angles, but ranging from forms in which the difference between the angles is but slight and the rays are of approximately equal length, to very strongly sagittal forms with the oral rays extended almost in a straight line and much longer and stouter than the basal ray (characteristic of the gastral cortex). The rays are fairly gradually and sharply pointed, and it is usual for the oral rays to be slightly curved or crooked while the basal ray is almost or quite straight. In a full-grown spicule with approximately equal rays the latter measure about 0·197 by 0·0184 mm.

(2) Quadriradiates; formed by the addition of a short apical ray to triradiates of the gastral cortex.

(3) Large oxea (fig. 8*b*); usually more or less club-shaped; stout, usually strongly curved, the bend being nearer to the distal end. Proximal portion usually nearly straight, gradually and sharply pointed. Distal portion irregular, usually crooked, ranging from gradually sharp-pointed to broadly rounded off at the end. Size about 0·43 by 0·034 mm.

(4) Microxea (figs. 8*c*, 8*d*); flattened, slightly curved, chiefly in the plane of flattening, divided into proximal and distal portions by a sharp annular ridge, about one quarter of the length from the distal end; both ends fairly gradually and sharply pointed; size about 0·082 by 0·006 mm. (at the ridge-like thickening). These spicules show very distinctly the differences in appearance, according to whether they are viewed lying flat or edgewise, which led Minchin to believe in the existence of two kinds of oxea in the genus *Leucosolenia**. In the former case (fig. 8*c*) they appear very pale, with weak outlines, in the latter (fig. 8*d*) darker, much more refringent, and narrower.

(5) Trichoxea; about 0·39 mm. long and of hair-like thinness.

The unusually strong tendency of the triradiates to assume a sagittal character prevents us from regarding this species as a perfectly typical *Leucetta*, but the nuclei of the collared cells are distinctly basal and there are no vestiges of an articulate tubar skeleton. The large oxea recall those of *Leucascus clavatus* Dendy [1892], both as regards form and arrangement, and the entire organisation suggests the close relationship of *Leucascus* and *Leucetta* assumed by Dendy and Row [1913]. There appears to be no species of *Leucetta* hitherto described with both large oxea and microxea, though they occur together in an unpublished species of Row's (*L. expansa*).

Register Nos., Locality, &c.—I, 1–9, Macquarie Is. Picked up on beaches after storm, West Coast; V, 1, 2, beach, Macquarie Island.

GRANTIA CIRRATA *Jenkin* var. AURORÆ *nov.*

(Plate I, figs. 4, 9*a*–9*d*.)

Leucandra cirrata Jenkin [1908].

There are several specimens or fragments of specimens of this variety in the collection, a complete individual being represented in fig. 4. The sponge is elongately cylindrical, or more or less compressed (? artificially); slender; of pretty uniform diameter for the greater part of its length but narrowing gradually above to the naked, terminal vent, and below to the point of attachment. The specimens are more or less curved in their present condition. The largest (R.N. IV, 2) measures about 18 mm. in length by 3 mm. in maximum diameter. The surface, when viewed under a pocket lens, appears, to use Jenkin's expression, as if covered with short, curling hair, owing to the large projecting oxea, but this character is hardly visible to the naked eye. The colour in spirit should evidently be nearly white, but is actually deeply tinged with green by copper dissolved in the spirit.

* *See* under *Leucosolenia botryoides* var. *macquariensis*.

The canal system is syconoid or perhaps somewhat "sylleibid" with large, glove-finger-shaped chambers; but the preservation is not sufficiently good to afford satisfactory details.

The skeleton arrangement is that of a typical Grantia. The cortical skeleton is rather strongly developed on both dermal and gastral surfaces, consisting of several layers of tangentially disposed radiates. The gastral surface is abundantly echinated by the short, stout, apical rays of the gastral quadriradiates, and the dermal surface by the outer portions of the large, crooked oxea, whose inner portions penetrate at right angles through the chamber layer, sometimes even to the gastral cortex. The articulate tubar skeleton is well developed, consisting of several "joints," and the basal rays of the subgastral sagittal triradiates may extend through almost the entire thickness of the chamber layer.

The only important respect in which the spiculation (figs. 9*a*–9*d*) seems to differ from that of the type of the species concerns the form of the large, crooked oxea (fig. 9*d*), whose outer ends are commonly broadly rounded off, or even knobbed (but not hastate) at the extremity, a character which seems to occur only in the short peristomial oxea of the type. They may be bluntly and asymmetrically pointed, but never seem to show the long, slender tapering which characterizes the type. Their inner ends, on the other hand, taper very gradually to fine points.

I have examined the original preparations of Jenkin's *Leucandra cirrata*, from the Antarctic, now in the British Museum (Natural History), and have come to the conclusion that it is not a typical *Leucandra* but referable rather to the genus *Grantia*, the flagellate chambers being large and glove-finger-shaped. The large subdermal cavities mentioned by Jenkin are probably due, at least partly, to shrinkage.

Unfortunately I am in considerable doubt, owing to inadequate labelling, as to the locality from which the specimens in the "Aurora" collection were obtained. They reached me in a glass tube containing two labels. One, apparently the original, had "No. 1" on one side and "Porifera" on the other. This label had a copper or brass eyelet ring, the corrosion of which had stained both label and specimens green. The second label was evidently of more recent date and bore the words "Porifera No. II," all on the same side. It seems possible that the "No. II" refers to the Station. The type of the species was obtained at the Winter Quarters of the "Discovery" Expedition.

Register Nos., Locality, &c.—IV, 1, 2, 8, 10–14 (some merely fragments). ? Station II. (lat. S. 66° 55′; long., E. 195° 21′). 3/8-fms.

GRANTIA TENUIS *Urban* [1908, 1909].

Some fragmentary specimens of this species were found in the same tube with those of *Grantia cirrata* var. *Auroræ*, with which I at first thought that they were specifically identical. They can, however, be distinguished quite readily by the form of the large oxea, which are shorter and much less crooked, with the short distal portion often separated from the long proximal one by an annular thickening; also by the

numerous very slender oxea (trichoxea) arranged radially in bundles in the chamber layer and sometimes projecting from the surface. One fragment shows a fair number of microxea, not impossibly derived from a *Leucosolenia* in the same tube, or possibly young forms of the large oxea (?). Microxea seem to be absent from the type. The large oxea are very distinctly flattened and show very clearly the difference in refringence, according to the point of view, to which I have referred in the case of *Leucosolenia botryoides* var. *macquariensis* and *Leucetta macquariensis*.

The same uncertainty exists as to the locality of these specimens as in the case of *Grantia cirrata* var. *auroræ*. The type of the species was obtained at Kerguelen.

Register Nos., Locality, &c.—IV, 5–7, ? Station II (lat., S. 66° 55′; long., E. 195° 21′).

Leucandra mawsoni *n. sp.*

(Plate I, figs. 5, 10*a*–10*d*).

The single specimen in the collection (fig. 5) is an elongated sac-shaped sponge, strongly compressed laterally and with a single terminal vent. The shape is somewhat irregular, the lateral margins growing out here and there into lobose projections which look like incipient buds, but there is only one vent, and the sponge may be regarded as consisting of a single leucon individual. It is contracted below to an ill-defined, stout, but compressed stalk, whereby it is attached to a pebble; it also diminishes gradually in breadth upwards to the wide vent. The dermal surface is smooth but slightly uneven, and appears very minutely reticulate under a pocket lens. The vent is naked, without any distinct collar but with a very narrow, thin margin. The specimen is large for a solitary calcareous sponge, measuring about 87 mm. in height, with a maximum breadth of about 27 mm. (where one of the marginal lobes comes off) and a thickness of only about 3 to 4 mm. The vent measures about 6 mm. in long diameter and leads into a wide central gastral cavity. The walls of this cavity are only about 1·5 to 2 mm. in thickness and almost touch one another, being in fact bolted together here and there by trabeculæ formed from the lining of the gastral cavity. The gastral surface is smooth but uneven, with the rather wide openings of the exhalant canals sparsely scattered over it. The colour in spirit is pale yellowish-grey, the texture firm but flexible.

The skeleton is rather feebly developed, owing to the fact that the spicules, though very numerous, are slender-rayed. That of the chamber layer consists of regular triradiates, with long and very slender rays, quite irregularly scattered between the flagellate chambers. That of the thin gastral cortex consists of similar spicules lying tangentially and rarely with a feebly developed apical ray. The dermal cortex is also thin, but its skeleton is fairly dense and consists of somewhat stouter triradiates, lying tangentially; occasionally the spicule is turned so that one ray dips down into the chamber layer, but I do not think that any importance need be attributed to this condition.

Spicules :—

(1) Regular triradiates of the chamber layer and gastral cortex (fig. 10*a*). Equiangular and equiradiate, with long, slender rays all lying approximately in the same plane. Rays nearly cylindrical and rather abruptly pointed, often very slightly crooked, or irregular in thickness; measuring about 0·2 by 0·005 mm.

(2) Quadriradiates of the gastral cortex (fig. 10*d*); very similar to the triradiates just described, but with a feebly developed apical ray, usually represented by nothing more than a small knob.

(3) Regular triradiates of the dermal cortex (figs. 10*b*, 10*c*), with the rays bent in such a way that the centre of the spicule is lifted up considerably above the plane in which the three apices lie. Rays conical, fairly gradually but not very sharply pointed, stouter than those of the radiates above described; measuring, say, about 0·12 mm. in length by 0·012 mm. in diameter at the base, but, of course, variable. In boiled-out preparations, these spicules are usually found resting on two of the rays, with the third tilted up and commonly broken off short, as shown in fig. 10*c*.

The canal system is "sylleibid" in type, the flagellate chambers being large and irregularly sac-shaped, measuring about 0·26 mm. in maximum diameter. The inhalant pores are thickly scattered over the outer surface and lead through the dermal cortex into the large, irregular, inhalant lacunæ. Similar, but larger, exhalant lacunæ, formed by the union of smaller ones, open on the gastral surface.

The specimen is badly preserved histologically and I have not been able to determine the position of the nuclei in the collared cells.

As regards canal system, this species resembles *Leucandra australiensis*, as figured by myself (1893), but it differs in the absence of oxea, as well as in other respects. Of previously fully described species the one which, perhaps, comes nearest to it seems to be *Leucandra telum*, which Lendenfeld (1891) referred to his genus Polejna, characterized by the "Sylleibid" canal system combined with the absence of oxea; but the two differ widely in external form, as well as in skeletal features.

Three Antarctic species described by Jenkin (1908), viz.—*Leucandra frigida L. brumalis*, and *L. gelatinosa*, belong to the same section of the genus, but their canal system is very imperfectly known, and in any case they seem to be quite distinct from *L. mawsoni*.

Altogether *Leucandra mawsoni* appears to be a very well characterised species, easily recognised by its external form and by the peculiar, almost tripod-like dermal triradiates.

I have much pleasure in dedicating this species to the distinguished leader of the Expedition, Sir Douglas Mawson.

Register No., Locality, &c., III, Station VII (lat. S. 65° 92′, long. E. 92° 10′), 60 fathoms, 21–1–14.

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DESCRIPTION OF PLATES.

Fig. 1.—*Leucosolenia botryoides* (Ellis and Solander) var. *Macquariensis* nov., R.N. I, 11, × about $1\frac{2}{3}$.

Fig. 2.—*Leucetta antarctica* n. sp. R.N. VI, about natural size.

Figs. 3*a*–3*d*. *Leucetta macquariensis* n. sp., about natural size.
3*a*, R.N. I. 1; 3*b*, R.N. I 2; 3*c*, R.N. I 3; 3*d*, R.N. V 2.

Fig. 4. *Grantia cirrata* Jenkin var. *auroræ* nov. R.N. IV, 2, × about $1\frac{2}{3}$.

Fig. 5.—*Leucandra mawsoni* n.sp. R.N. III, about natural size.

Figs. 6*a*–6*e*.—*Leucosolenia botryoides* (Ellis and Solander) var. *macquariensis* nov. R.N. I 11. Spicules, × 280. 6*a*, triradiates; 6*b*, quadriradiates, facial view; 6*c*, quadriradiates, side view; 6*d*, oxea, lying on flat side; 6*e*, oxea, lying on edge.

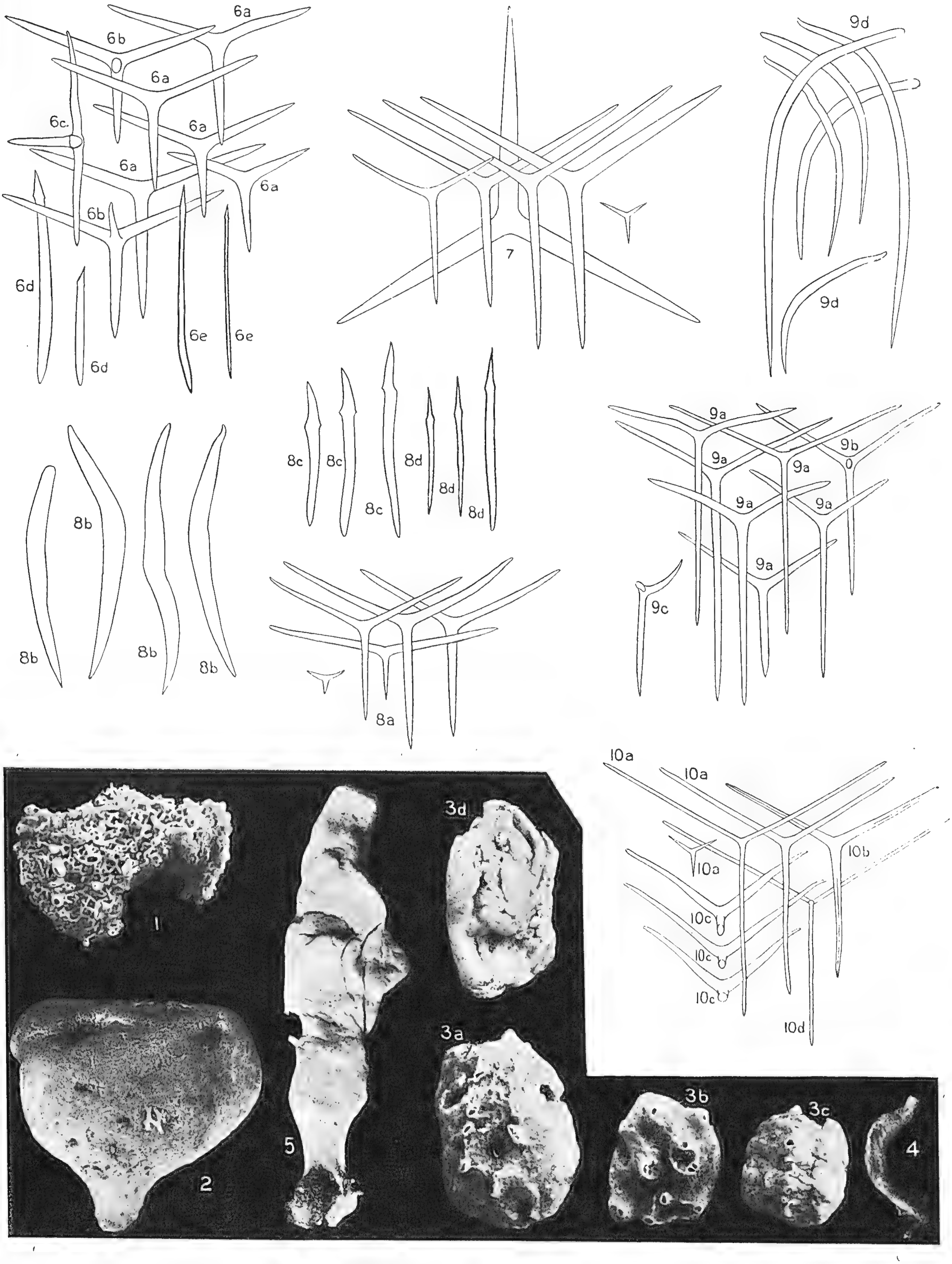
Fig. 7.—*Leucetta antarctica* n.sp. R.N. VI, Spicules, × 120.

Figs, 8*a*–8*d*.—*Leucetta macquariensis* n.sp. R.N. I 1. 8*a*, triradiates, × 120; 8*b*, large oxea, × 120; 8*c*, microxea, lying on flat side, × 455; 8*d*, microxea, lying on edge, × 455.

Figs. 9*a*–9*d*.—*Grantia cirrata* Jenkin var. *auroræ* nov. R.N. IV 1, Spicules.
9*a*, Triradiates, × 160; 9*b*, quadriradiates, facial view, × 160; 9*c*, quadriradiates, side view, with the two oral rays broken off, × 160; 9*d*, *oxea*, × 105.

Figs. 10*a*–10*d*.—*Leucandra mawsoni* n.sp. R.N. III, Spicules, × 160. 10*a*, ordinary triradiates; 10*b*, dermal triradiates, resting on the apices of the three-cornered rays; 10*c*, dermal triradiates lying on two rays, with the third tilted up and broken off; 10*d*, quadriradiate.

INDEX.


6a
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9a
9c
10a
10a
10a
10b
10c
10c
10c
10d
1
2
5
3d
3a
3b
3c
4

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1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, D.Sc., B.E.

SCIENTIFIC REPORTS.

SERIES C.—ZOOLOGY AND BOTANY.

VOL. VI. PART 2.

THE CHÆTOGNATHA.

BY

PROFESSOR T. HARVEY JOHNSTON, M.A., D.Sc., C.M.Z.S.,

AND

B. BUCKLAND TAYLOR, F.L.S.

WITH THREE PLATES.

PRICE: ONE SHILLING AND TENPENCE.

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V.	7.	OSTRACODA. By Mr. Frederick Chapman, A.L.S., F.R.M.S., National Museum, Melbourne ...	4 7
V.	8.	THE INSECTS OF MACQUARIE ISLAND. By R. J. Tillyard, M.A., D.Sc., F.L.S., F.E.S., with APPENDICES by Prof. C. T. Brues, Ph.D., and A. M. Lea, F.E.S.	2 9
VI.	1.	CALCAREOUS SPONGES. By Prof. A. S. Dendy, D.Sc., F.R.S., F.Z.S., King's College, London	2 0
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VII.	3.	THE VASCULAR FLORA OF MACQUARIE ISLAND, By T. F. Cheeseman, F.L.S., F.Z.S., Auckland Museum, N.Z.	6 6
VII.	4	BACTERIOLOGICAL AND OTHER RESEARCHES By A. L. McLean, B.A., M.D., Ch.M. (M.C.)	16 0

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THE CHÆTOGNATHA

By Professor T. Harvey Johnston, M.A., D.Sc., C.M.Z.S., and B. Buckland Taylor, F.L.S., Biology Department, University, Brisbane.

With Three Plates.

INTRODUCTION.

Collections of Chætognatha from Antarctic and Subantarctic waters have been examined by Steinhaus (1900), Fowler (1907), Ritter-Zahony (1911), and Jameson (1914). A species, probably *Eukrohnia hamata*, has been referred to by Parker as having been collected to the south of Stewart Island, New Zealand, and other Subantarctic Islands. This occurrence was discussed by Fowler (1907).

We have taken a very wide definition of the words "Antarctic" and "Subantarctic," including thereunder every position south of 40° S. This latitude is a somewhat arbitrary one as far as climate is concerned, more particularly immediately to the south of Australia and Tasmania, the Tasman Sea and New Zealand, where the temperatures are rather higher than they are in corresponding latitudes in most other parts of the Subantarctic region.

MATERIAL COLLECTED.

The collection consisted of (1) material obtained in tow-nets at four stations, from depths ranging from 2 to 400 fathoms; and (2) several specimens found on the beach at Macquarie Island.

The various dates and locations were as follows:—

Date unrecorded.—Maria Island, on the west coast of Tasmania, the most northerly station at which Chætognatha were obtained. Material from 6 fathoms.

18–19th June, 1912.—Twelve hours tow-netting in the vicinity of Macquarie Island at a depth of 2 fathoms.

21st June, 1912.—In 2 fathoms at Macquarie Island.

March, 1913.—Specimens found on the beach at Macquarie Island.

4th January, 1914.—At 64° 18′ S.: 132° 24′ E. from 45 fathoms.

10th January, 1914.—At 64° 34′ S.: 117° 1′ E. Two hauls were made with a closing net, one at 100 fathoms and one at 400 fathoms.

Altogether several hundreds of specimens of Chætognatha were collected, representing two genera, eight species and one new variety, two of the species being collected from these waters for the first time. One genus, *Heterokrohnia,* and one species of *Sagitta, S. maxima,* which have been recorded by Jameson (1914) within the Antarctic circle, off Coats' Land, were not obtained by the Australian Antarctic Expedition.

The appearance of our specimens varied very considerably according to the medium in which they had been kept, those individuals which were preserved in alcohol being totally different to the naked eye from others of the same species which had been preserved in formalin, the latter retaining their shape well and remaining more or less opaque, according to their nature, whereas the alcohol had caused normally firm and turgid species to become rather flaccid and quite transparent, while its effect on normally flaccid species was such as to make the taking of correct measurements a matter of considerable difficulty. The specimens which best showed the contrasting effect of the two media were *S. lyra* and *Eukrohnia hamata.* In the former species, until the heads had been examined under the microscope and various measurements had been made, the contrast between the specimens obtained on the beach at Macquarie Island and preserved in formalin, and a few others preserved in alcohol, was so great that it seemed almost incredible that they belonged to the same species. Those individuals of *E. hamata* which had been kept in formalin were quite darkly-coloured and firm, but the alcohol in other cases had made the material quite colourless and flaccid, so that the general appearance of the animal was of no assistance in identification.

SYSTEMATIC ACCOUNT.

Sagitta hexaptera *d'Orbigny.*

1843. *S. mediterranea* Forbes.

1844. *S. bipunctata* Krohn.

1870. *S. tricuspidata* Kent.

1880. *S. magna* Langerhans.

1881. *S. longidentata* Grassi.

Several specimens of this form were captured at various stations, some of which arrived dry in a broken tube. However, it was possible to identify all the individuals by means of their characteristic cephalic armature, together with the body proportions. The largest was 33 mm. in length. The jaws and posterior teeth were in excess of the usual number, the jaws of our specimens varying in number from 8 to 11, and the posterior teeth from 5 to 7; the usual number of jaws being 7 or 8 (rarely up to 10), and of posterior teeth from 4 to 6.

Specimens were obtained as follows :—

18th June, 1912, at 2 fathoms, Macquarie Island.

21st June, 1912, at 2 fathoms, Macquarie Island.

10th January, 1914, at 100 fathoms, from 64° 34′ S. : 117° 1′ E.

10th January, 1914, at 400 fathoms, from 64° 34′ S. : 117° 1′ E.

The species had already been recorded from the Southern Ocean by Fowler (1907) and Jameson (1914).

SAGITTA LYRA *Krohn.*

(Plate II, figs. 1, 2, 3.)

1896. *S. furcata* Steinhaus.

1907. *S. hexaptera* Fowler (non d'Orb.).

1909. *S. gazellæ* Ritter-Zahony.

Of this species there were collected twenty-four individuals, which, as has already been mentioned, owing to different methods of preservation presented very different appearances.

Seven large robust dark-coloured opaque specimens, all over 40 mm. in length were washed up on a sandy beach at Macquarie Island. One specimen, measuring 40 mm., was taken at 100 fathoms; while others were collected from depths of 2 and 45 fathoms, these ranging in length from 18 to 36 mm.

Ritter-Zahony (1909, 1911) stated that the main difference between his species *S. gazellæ* and *S. lyra* lay in the form of the seizing jaws. His figure (fig. 7) is very like that of the jaw of *S. furcata* (Fowler, 1905, pl. 4, fig. 12), a species placed by Michael, Ritter-Zahony and others under *S. lyra.* The base was, however, somewhat different. On the other hand his figure (fig. 8) of the jaw of *S. lyra* resembles that drawn by Fowler (1905, pl. 6, fig. 41) for an undetermined species of *Sagitta,* which was afterwards placed by Ritter-Zahony (1911) as a synonym of *S. lyra.* Ritter-Zahony (1911, p. 8) said that in older specimens of *S. lyra* the jaws became claw-shaped. As will be seen from fig. 3, the tips of our specimens agree with his description of *S. lyra* in this respect, while the shaft of the jaw resembles his own figure of *S. gazellæ* (1911, fig. 7). This to our minds indicates that the differences in the form of the jaws as recorded are of no specific value.

Another point of difference emphasized by him is the shortness of the tail in *S. gazellæ.* In his original description of the species (1909) the tail was stated to be 10 to 14 per cent. of the total length, with one apparently abnormal measurement of 19 per cent. However, in his revision (1911) he gave tail ratios which ranged from 10 to 19 per cent., while in the same paper his measurements for *S. lyra* were 15 to 18 per cent., really nullifying one of his own points of difference between the two.

Michael (1911), in commenting on the likeness of the two species, expressed doubt whether there was sufficient difference to justify the creation of *S. gazellæ*, but stated that as a figure had not been published he let it stand. Since then Ritter-Zahony (1911) redescribed and figured the species, and it was with this redescription that we compared our specimens.

Our measurements for the tail percentages agreed fairly well with those given by Ritter-Zahony for *S. gazellæ*, with the exception of our No. 5, a specimen 36 mm. long, having a tail percentage of 11, while his specimen of *S. gazellæ* of a corresponding length had a tail percentage of 14 to 15. He also gave 15 to 16 per cent. for *S. lyra*, measuring 36 mm. The disparity between his figures and ours was probably due to shrinkage of our specimen, caused by preservation in alcohol. Our dimensions fitted the descriptions of either *S. gazellæ* or *S. lyra*, as given by Ritter-Zahony and Michael, except in the case of the No. 5 mentioned above; the latter was apparently a rather abnormal specimen, the number of its jaws being 13, which was greater than that recorded for either of the species, the maximum being 9 for *S. lyra*, and 10 for *S. gazellæ*.

The ovaries were immature in all our individuals, so comparison of this feature was impossible.

Another distinction between the two mentioned by him was that in *S. lyra* the posterior fin overlapped the anterior (1911, fig. 3), whereas in *S. gazellæ* he stated that the two were continuous in young specimens, becoming separated later (1911, p. 10). This was the only point of difference we could find in regard to the descriptions, and as in the text he stated that the fins were confluent in *S. lyra*, we have felt fullv justified in placing *S. gazellæ* as a synonym of *S. lyra*.

Jameson (1914) recorded *S. gazellæ* from the Antarctic, but though he distinguished it from *S. hexaptera*, he did not discuss its likeness to *S. lyra*, to which his description would apply equally well. Some of his specimens were extraordinarily large, one attaining a length of 90 mm.

Measurements, &c., of Selected Specimens.

No.	Length in mm.	Tail %.	Jaws.	Antr. Teeth.	Postr. Teeth.
1	18·5	16	9	3	4
2	19	15·7	11	1	3
3	19	18	8	3	4
4	20	17	9	7	11
5	36	11	13	5	6
6	40	15	9	5–6	5–6
7	40	15·5	8	7	6

Specimens were obtained as follows:—

18–19th June, 1912, at 2 fathoms, Macquarie Island.

March, 1913, on the beach, Macquarie Island.

4th January, 1914, at 45 fathoms, from 64° 18′ S. : 132° 24′ E.

10th January, 1914, at 100 fathoms, from 64° 34′ S. : 117° 1′ E.

10th January, 1914, at 400 fathoms, from 64° 34′ S. : 117° 1′ E.

The species had already been recorded from Antarctic or Subantarctic waters by Fowler (1907) as *S. hexaptera*; and by Ritter-Zahony (1909) and Jameson (1914) as *S. gazellæ*.

SAGITTA MACROCEPHALA *Fowler.*

Only two specimens were obtained (one in a very imperfect condition), and, as will be seen from the accompanying table, they were not normal adult individuals of *S. macrocephala*, but compare closely in their doubtful points with certain of Fowler's specimens obtained from the Bay of Biscay, which shewed a marked decrease in the number of posterior teeth, and regarding which that author stated, "I think they are larval *macrocephala*, but they are very small, and the number of posterior teeth drops rather suddenly." As they were like *S. macrocephala* in appearance, proportional measurements, number and shape of the jaws, and since Fowler's numbers for the teeth in his larval forms corresponded with our own, we have placed them in this species, though with some reserve.

Measurements, &c., of our Specimens.

Length in mm.	Tail % of Length.	Jaws.	Antr. Teeth.	Postr. Teeth.
7	30	9	3	6
9	36	10	3	9

The specimens were obtained on 10th January, 1914, at 100 fathoms from 64° 34′ S. : 117° 1′ E.

Not hitherto recorded from the Antarctic.

SAGITTA NEGLECTA *Aida.*

1902. *S. septata* Doncaster.

This form was not at all common, only four specimens being captured. The only variation exhibited was the possession of 10 seizing jaws, this being two in excess of the usual number.

The species was regarded by Ritter-Zahony (1911) as a tropical, Indo-Pacific epiplanktonic form, so its occurrence at 100 fathoms in the vicinity of the Antarctic circle was remarkable. However, as we have said above, the only point in which the

specimens did not agree with the descriptions of *S. neglecta,* was in the presence of the two extra jaws. We concluded that the species has a wider range than had hitherto been suspected.

The specimens were obtained on 10th January, 1914, at 100 fathoms from 64° 34′ S. : 117° 1′ E.

Not hitherto recorded from the Antarctic.

SAGITTA PLANCTONIS *Steinhaus.*

1896. *S. hexaptera* Conant (non d'Orb.).

1905. *S. zetesios* Fowler.

Of this species only four individuals were captured, no variation being exhibited.

The specimens were collected on—

10th January, 1914, at 100 fathoms, from 64° 34′ S. : 117° 1′ E.

10th January, 1914, at 400 fathoms, from 64° 34′ S. : 117° 1′ E.

Already recorded from the Antarctic and Subantarctic by Ritter-Zahony (1911); Fowler (1905) as *S. zetesios*; and by Jameson (1914).

SAGITTA SERRATODENTATA *Krohn.*

This species was present in two hauls; on one occasion no other Chætognatha were captured, while in the other haul only one representative of the species was present. The individuals shewed no variation. They ranged from 6 to 13 mm. in length, and many were sexually mature.

The specimens were collected on—

21st June, 1912, at 2 fathoms, Macquarie Island.

Date unknown, at 6 fathoms, Maria Island, in which haul no other species was represented.

Already recorded from Antarctic and Subantarctic waters by Steinhaus (1900) and Fowler (1905).

EUKROHNIA FOWLERI *Ritter-Zahony.*

1905. *Krohnia hamata* var. Fowler.

This species was not commonly represented, only 18 specimens in all being collected, but they were present in five different hauls, at depths ranging from 2 to 100 fathoms. In our individuals from 1 to 3 of the seizing jaws were saginated, and only 2 teeth were present. Fowler (1905, p. 78) found from 3 to 8 of the jaws saginated, and met with 2 to 4 teeth in specimens 6 to 8 mm. long. Michael (1919, p. 240) and Ritter-Zahony (1911, p. 40) mentioned that *E. fowleri* possessed pigmented eyes. This was not the case in any of our specimens, nor did Fowler refer to it in his original description.

The specimens were collected on—

18th June, 1912, at 2 fathoms, Macquarie Island.

21st June, 1912, at 2 fathoms, Macquarie Island.

4th January, 1914, at 45 fathoms, from 64° 18′ S. : 132° 24′ E.

10th January, 1914, at 100 fathoms, from 64° 34′ S. : 117° 1′ E.

10th January, 1914, at 400 fathoms, from 64° 34′ S. : 117° 1′ E.

Already recorded from the Antarctic by Ritter-Zahony (1911).

EUKROHNIA HAMATA *Mœbius.*

(Plate II, fig. 5. Plate III, figs. 8, 12.)

1875. *S. hamata* Mœbius.

1880. *Krohnia hamata* Hertwig.

1880. *Spadella hamata* Hertwig.

1897. *Krohnia foliacea* Aida.

1912. *E. richardi* Germain and Joubin.

This species was far more numerously represented than any other, being collected in every haul except one. There were present in all about 300 individuals, ranging from 7 to 26 mm. in length.

Those of our specimens which were preserved in formalin were of a water-green colour, while those preserved in alcohol were quite colourless. The flask-shaped corona was present on one, and a small collarette on several of our specimens (fig. 8). The anus opened on a small, but distinct, anal papilla (fig. 5).

Germain and Joubin (1912) created a new species, *E. richardi*, distinguishing it from *E. hamata* by—

1. "The water-green colour." This coloration has been found by Michael (1911 p. 267) and ourselves to occur also in undoubted specimens of *E. hamata.*

2. "The elongated triangular head." This depends on the state of contraction.

3. "The more narrowly elongated jaws." Michael (1911, p. 267) quoted this character, and yet stated (p. 268) that the seizing jaws were *more massive* (the italics are ours) than those of *E. hamata*, and that their points were quite dissimilar. On p. 240 of the same paper he gave a key to the species of *Eukrohnia*, in which the seizing jaws of *E. hamata* and *E. fowleri* were stated to be delicate. Our specimens of *E. fowleri* had slender jaws, but all the *E. hamata* individuals had massive jaws with typical *E. hamata* points, *i.e.*, sickle-shaped. The jaws of all our specimens were much more massive than his figure (pl. 37, fig. 27), but the tips were similar, and, though not all were so markedly sickle-shaped, were certainly as much so as that figured by him (1911, pl. 4, fig. 35). On turning to Fowler's paper (1906, pl. 11, fig. 80),

where the jaws of the *E. hamata* collected by the Siboga Expedition were figured, one found three small drawings of the points, one of which was even less curved than in Michael's (1919) drawing of the point of the jaw of *E. richardi* (pl. 37, fig. 26).

4. "The number of teeth." This character was of no specific value in this case, since Germain and Joubin quoted 24 as the number in *E. richardi*, while Ritter-Zahony (1911) gave 4 to 23, and Michael (1919, p. 226) 21 to 25 as the number for *E. hamata*.

5. The maximum width of the body was stated in the text to be 9·3 per cent. of the total length. Including damaged fins, one of our specimens had a width of 9·5 per cent. Michael, who regarded *E. richardi* as a valid species, found certain discrepancies between Germain and Joubin's text and their figures. He gave a table comparing the measurements of his specimens and those of the above-mentioned figures, in which he indicated the width of the figures as 12·2 per cent., but in his text he stated that this percentage was 11·5. Taking into consideration the very damaged condition of our material, there is not a very great difference between Michael's measurements of the drawing and ours, which were taken from undoubted *E. hamata*. We have examined individuals measuring in breadth from 5·7 per cent. of the total length (which was only ·1 per cent. greater than the measurement given for *E. hamata* by Michael, 1911, to 9·5 per cent., which was ·2 per cent. greater than Germain and Joubin's text figures of *E. richardi*, and 2 per cent. less than Michael's measurement of their drawing, which seemed to us to discredit the separation of the two species on a basis of width.

The distinctions given by Michael (1919) regarding the fins we cannot comment upon, as our specimens were much too damaged to obtain reliable measurements of these structures.

Given the above comparisons, and the fact that Germain and Joubin named the species from one specimen, and that Michael (1919) examined "five specimens, only two of which are well enough preserved to permit certain identification," we consider that we are justified in classing *E. richardi* as a synonym of *E. hamata*.

Neither Michael (1911, p. 52) nor ourselves observed a "bristly ridge" (Ritter-Zahony, 1911) on any of the seizing jaws.

The specimens were collected on—

18th June, 1912, at 2 fathoms, Macquarie Island.
21st June, 1912, at 2 fathoms, Macquarie Island.
4th January, 1914, at 45 fathoms, from 64° 18′ S. : 132° 24′ E.
10th January, 1914, at 100 fathoms, from 64° 34′ S. : 117° 1′ E.
10th January, 1914, at 400 fathoms, from 64° 34′ S. : 117° 1′ E.

Already recorded from the Antarctic and Subantarctic regions by Steinhaus (1900); Fowler (1907) as *Krohnia hamata*; and Jameson (1914) as *K. hamata*.

EUKROHNIA HAMATA var. ANTARCTICA var. nov.

(Plate II, figs. 4, 6. Plate III, figs. 7, 9, 10, 11.)

Nine individuals of this variety were collected, none very well preserved. One had been kept in alcohol, and in consequence was much more transparent and flaccid than the others, while the remaining eight had apparently been allowed to dry slightly at some time and, as a consequence, were rather distorted. Their length ranged from 16·5 to 21 mm.

We have considered these specimens as constituting a variety of *E. hamata* on two grounds:—

1st.—Because of the curious coiling of the ovaries as the individuals progressed towards female maturity. Specimens of *E. hamata* and var. *antarctica* in which the sexual organs were very immature, were indistinguishable in regard to the ovary, but older individuals of both were totally different in this feature, as can be seen by comparing figs. 4 and 5, 9 and 12. The var. *antarctica* was protandrous, the ovaries remaining small and straight, while the tail gradually became filled by the testes and sperm, then, just at the height of male maturity the ovaries began to coil inwards towards the tail septum, first one, then the other (fig. 9), and by the time the male products had been discharged, the ovaries had increased enormously in length and breadth, and lay tightly coiled just in front of the septum (figs. 4 and 10). At this latter stage it was impossible to distinguish the empty testes.

2nd.—Traces of the corona which were observable on one individual (fig. 7) showed that its form was different from that of *E. hamata,* being probably a broad oval lying on the head and neck, as compared with the flask-shaped corona of *E. hamata.*

The vesiculæ seminales were extremely small, and unless filled with sperm, were very difficult to see, as they were quite flat (fig. 11). They were only 6 per cent. of the total length from the posterior end of the tail, and the tail fin reached them.

A row of very pronounced papillæ (fig. 6) lay between two prominences at the extreme anterior end of the head; these, though present, were not so easily observable in *E. hamata,* and as we have not seen any detailed drawings of the head of the latter, we do not know if other observers have already figured them for the species.

The curvature of the jaws, measured according to Michael's formula (1911, p. 23) was 38 per cent.; the tips were inserted in the shaft for 21 per cent. of their length.

The specimens were captured on 10th January, 1914, at 100 fathoms from 64° 34′ S. ; 117° 1′ E.

SPECIES ALREADY RECORDED FROM THE ANTARCTIC, BUT NOT COLLECTED BY THE AUSTRALIAN ANTARCTIC EXPEDITION.

Heterokrohnia sp. *Ritter-Zahony.*

Recorded by Ritter-Zahony (1911) from the Antarctic at 2,000 and 3,423 metres; and by Jameson (1914) at 1,000 fathoms from 68° 25′ S. : 27° 10′ W.

Sagitta maxima *Conant.*

1885. Sp. innom., Verrill.
1892. *S. hexaptera* Strodtmann.
1896. *Spadella maxima* Conant.
1896. *S. whartoni* Fowler.
1905. Sp. indeterm., Fowler.
1906. *S. gigantea* Broch.

This species, which is regarded as valid by Ritter-Zahony, though Michael (1911) considered it a synonym of *S. lyra*, is recorded by Jameson (1914) as having been obtained by the Scottish National Expedition in a net lowered to 1,000 fathoms in 71° 50′ S. : 23° 30′ W., and at 1,332 fathoms from 48° 00′ S. : 9° 50′ W.

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EXPLANATION OF PLATES.

(All figures, with the exception of No. 3, were drawn with the aid of the camera lucida.)

PLATE II.

Fig. 1. *Sagitta lyra.* Head.
2. *S. lyra.* Jaw.
3. *S. lyra.* Point of jaw.
4. *Eukrohnia hamata* var. *antarctica.* Empty ovaries.
5. *E. hamata.* Region of tail septum.
6. *E. hamata* var. *antarctica.* Ventral surface of head.

PLATE III.

7. *E. hamata* var. *antarctica.* Head and neck.
8. *E. hamata.* Head and neck.
9. *E. hamata* var. *antarctica.* Posterior region.
10. *E. hamata* var. *antarctica.* Ovaries.
11. *E. hamata* var. *antarctica.* Seminal vesicles.
12. *E. hamata.* Posterior region.

PLATE IV.

Chart of the Antarctic showing localities from which Chætognatha have been recorded.

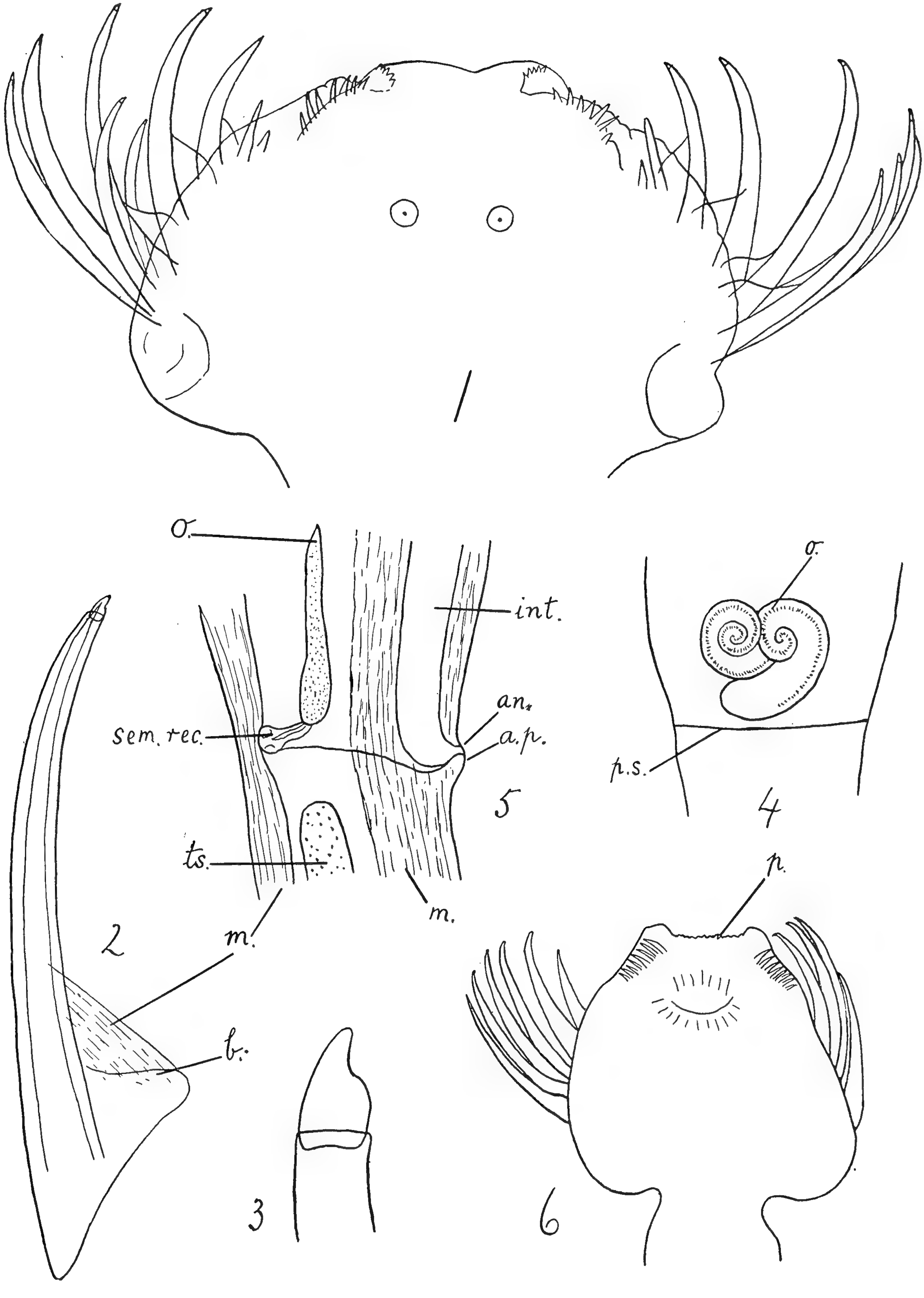
REFERENCES TO LETTERING.

an.—anus.
a.p.—anal papilla.
a.f.—anterior fin.
b.—edge of base.
col.—collarette.
cor.—corona ciliata.
g.—brain.
int.—intestine.
m.—muscle.
o.—ovary.
p.—papillæ.
p.f.—posterior fin.
p.s.—tail septum.
sem. rec.—seminal receptaculum.
sem. ves.—seminal vesicle.
t.f.—tail fin.
ts.—testes.

INDEX.

[3 PLATES.]

Sydney: William Applegate Gullick, Government Printer.—1921.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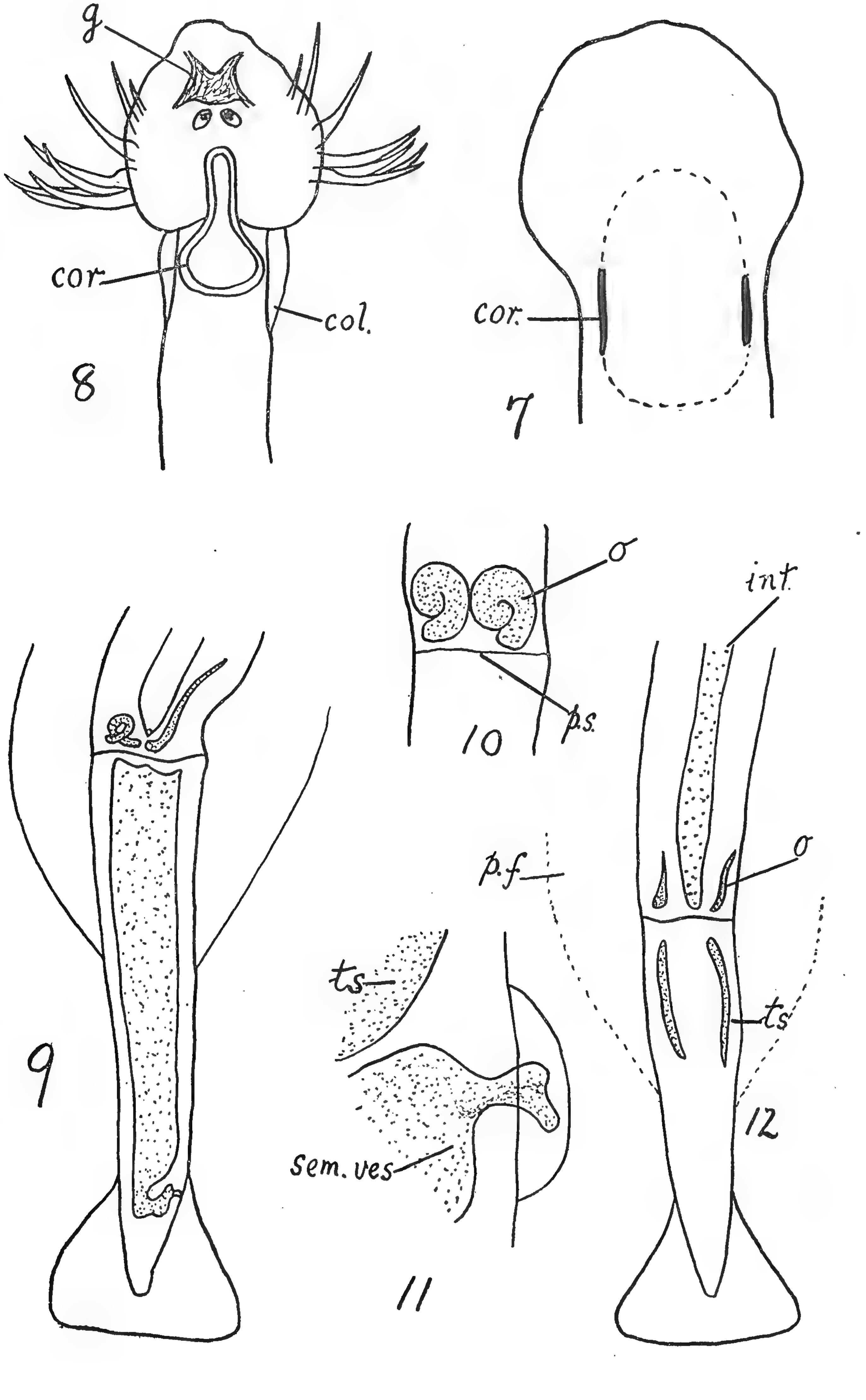
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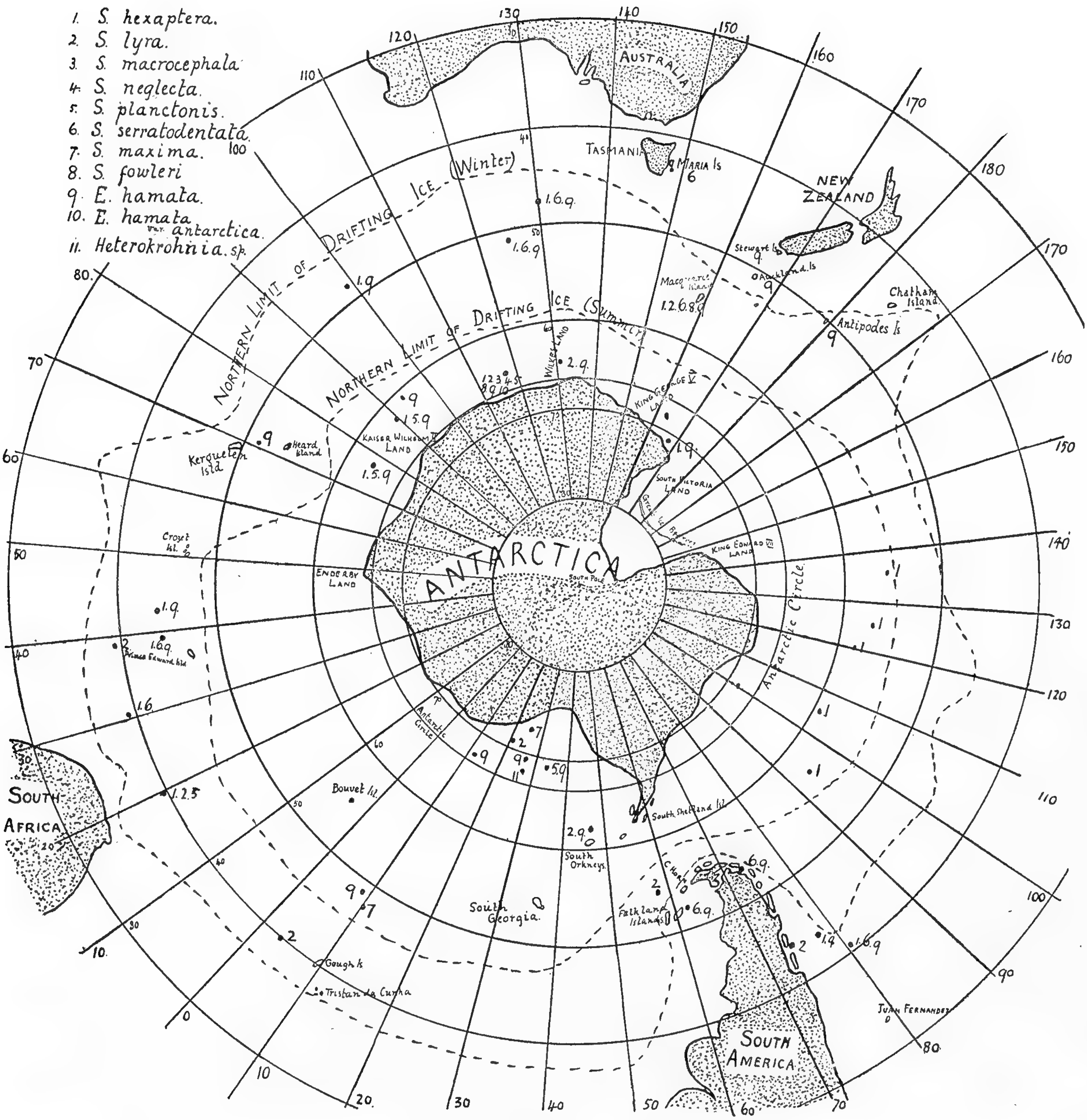
1. S. hexaptera.
2. S. lyra.
3. S. macrocephala
4. S. neglecta.
5. S. planctonis.
6. S. serratodentata.
7. S. maxima.
8. S. fowleri
9. E. hamata.
10. E. hamata var. antarctica.
11. Heterokrohnia. sp.
AUSTRALIA
TASMANIA
Maria Is
NEW ZEALAND
Stewart Is
Auckland Is
Chatham Island
Antipodes Is
NORTHERN LIMIT OF DRIFTING ICE (Winter)
NORTHERN LIMIT OF DRIFTING ICE (Summer)
Wilkes Land
KING GEORGE V LAND
KAISER WILHELM II LAND
Kerguelen Isld
Heard Island
SOUTH VICTORIA LAND
KING EDWARD VII LAND
Crozet Isl.
ENDERBY LAND
ANTARCTICA
South Pole
Antarctic Circle
Prince Edward Isl
SOUTH AFRICA
Bouvet Isl.
South Shetland Isl.
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1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, D.Sc., B.E.

SCIENTIFIC REPORTS.

SERIES C.—ZOOLOGY AND BOTANY.

VOL. VI. PART 3.

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BY

W. B. BENHAM, M.A. (Oxon.), D.Sc. (Lond.), F.R.S., F.N.Z.Inst.

WITH SIX PLATES AND A MAP.

PRICE: TWELVE SHILLINGS.

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AUSTRALASIAN ANTARCTIC EXPEDITION.

POLYCHÆTA—W. B. BENHAM.

ERRATA.

P. 7.—The number of Antarctic species should be 140 instead of 128.

P. 16, line 23.—"Phyllococe" should read "Phyllodoce."

P. 19.—In the list of Macquarie Island species, "assimils" in penultimate line should read "assimilis."

P. 25, line 4.—For "a symmetrical" read "an asymmetrical."

P. 73, line 13 from foot.—Last words "L. claparedi" should read "O. claparedi."

P. 85, line 5.—"Introduction, p. 10" should read "p.x."

P. 122.—I did not see proofs of the plates, and unfortunately the letterings of certain figures illustrating the structure of Phyllocomus and Amythas have been omitted.

P. 125.—"Dibranchiata Phyllcomus" should read "Phyllocomus"

*43173

CONTENTS.

POLYCHÆTA.

By W. B. Benham, M.A. (Oxon.), D.Sc. (Lond.), F.R.S., F.N.Z.Inst., Professor of Biology, University of Otago, New Zealand.

With Six Plates and a Map.

INTRODUCTION.

The Polychæt fauna of the Antarctic and Sub-antarctic regions is perhaps as well known as that of any other region, with the exception, it may be, of that of the North Sea and Mediterranean, which has been studied intensively by numerous zoologists for nearly a century.

In defining the extent of the Antarctic region I follow Ehlers, who includes not only the shores of the land-mass, but those islands which lie to the south of the outermost limit of the drifting sea-ice; thus the islands of South Georgia and Bouvet are included, while the Falkland, Crozet and Kerguelen Islands belong to the Sub-antarctic region.

The various expeditions to these high southern latitudes have brought back a considerable number of worms, many of which, indeed the majority, are confined to these two regions.

During the voyages of the "Eugenie" (1851–1853), of the "Challenger" (1873–1876), of the "Gazelle" (1876), and of the "Valdivia" (1898–1899) more or less extensive areas of the oceans were explored, but the Sub-antarctic region was visited only incidentally. To Kinberg we owe the foundation of our knowledge of the worms of this Notial region since the "Eugenie" visited Kerguelen and the Magellan Strait during its voyage. Other species were added by Grube in his report, while the accounts of McIntosh and Ehlers not only extended our knowledge of this region, but for the first time contain descriptions of worms from the Antarctic Seas; and these ships had been able to explore them to greater depths than had been possible previously.

Later expeditions, on the other hand, visited the edge of the Antarctic land-mass with the express purpose of studying the scientific problems presented by that region and these expeditions remained there for many months, so that the naturalists were afforded opportunities of making extensive collections of the marine animals living in the ice-covered sea.

Of these Antarctic expeditions, the "Southern Cross" (1898) had its winter quarters off Cape Adare in the Ross Sea; the "Discovery" (1901–1904), under Captain R. F. Scott, R.N., was held fast in the ice for two years in McMurdo Bay, South Victoria Land; both these places being to the south of New Zealand. The German South-polar expedition on the "Gauss" (1901-1903) wintered off Kaiser Wilhelm II Land which lies to the south of Kerguelen; while the two French expeditions on the "Français" (1903–1905) and on the "Pourquoi Pas?" (1908–1910) explored the lands and islands to the south of America, wintering off Petermann Island.*

In the terms of Sir Clements Markham's subdivisions of the Antarctic land-mass, the two English expeditions explored and wintered in the "Victoria Quadrant"; the German in the "Enderby," and the French in the "Weddell Quadrant" (see Waite, 1916).

We have consequently collections of Polychæta from the seas extending more than half way round the Antarctic land-mass.

During the voyage of the "Erebus" and "Terror" (1839–1843), under Sir James Clarke Ross, R.N., the Antarctic was visited, but no report on Polychæta was issued. It is probable that the few isolated descriptions of worms from the "Antarctic," published by some of the earlier English Naturalists, such as Baird's *Eunice antarctica*, were collected by that expedition.

Other expeditions have visited the Antarctic in recent years, but the reports on the collections of Polychæta either have not yet been issued, or certain families only have received attention. The Belgian expedition (1897–1899) conveyed by the "Belgica," has apparently published no report on the group. Of those obtained by the Swedish expedition (1901–1903) the family Maldanidæ has been dealt with by Arwidsson. Of the Polychætes gathered by the "Scotia" during the Scottish National Expedition (1902–1904) the families Serpulidæ and Sabellidæ have been reported upon by Helen Pixell; and the Nereidæ by L. N. G. Ramsay; while the British Antarctic expedition (1907–1909), under Sir E. Shackleton, has not yet issued any report on the group.

Although these various expeditions collected chiefly from the Antarctic and Sub-antarctic regions, yet most of them took any opportunity that was presented of gathering animals elsewhere; but with these we are not concerned.

In order to compare the results obtained by the "Aurora" with those of previous expeditions, it may be convenient to tabulate the number of species collected, and the number of new species recorded from the Antarctic seas.

* The French expeditions obtained Annelids from various localities off the South Shetland group (*e.g.*, île Deception and Admiralty Bay), and from various stations near the islands lying to the north, and, chiefly, to the south of Graham Land, *e.g.*, Terre Alexandre, Terre Fallière, île Booth Wandel (where Port Charcot is situated), île Wiencke (Port Lockroy), île Petermann (at Port Circoncision), île Anvers (where is Biscoe Bay), &c. It will be sufficient to refer to these localities in general by the term "South American Antartic," rather than repeat every locality when listing distribution.

ANTARCTIC POLYCHÆTA.

Ship.	Total Number of Species.	Number of New Species.
Challenger	4	4
Southern Cross	15	3
Français	34	14
Valdivia	16	5
Pourquoi Pas?	34	13
Discovery	36	11
Gauss	83	20
Aurora	47	6

I have estimated from these various reports, including the present one, that about 128 species of Polychæta are known from the Antarctic seas.

Of these the families most abundantly represented are:—

Terebellidæ	25	species.
Syllidæ	21	,,
Phyllodocidæ	18	,,
Aphroditidæ	14	,,
Maldanidæ	10	,,
Serpulidæ	10	,,
Sabellidæ	9	,,
Ampharetidæ	7	,,
Opheliidæ, Typhloscolecidæ, and Chlorhaemidæ	6	each.
Amphinomidæ and Hesionidæ	5	,,
Alciopidæ and Ariciidæ	4	,,
Nereidæ, Eunicidæ, Sphærodoridæ, and Spionidæ	3	,,
Nephthydidæ, Tomopteridæ	2	,,

Glyceridæ, Capitellidæ, Scalibregmidæ, Ammocharidæ and Cirratulidæ are each represented by one species only.

The winter quarters of the "Aurora" were in Commonwealth Bay, Adelie Land, to the south of Australia; and it was here that most of the collecting was carried out. A small party had been left on Macquarie Island in connection with the Meteorological and Wireless Station, and during the two years spent here a number of Polychætes and Oligochætes were gathered around the shore.

A few worms were also obtained by trawling off Maria Island, Tasmania, under the supervision of Professor T. T. Flynn, of the University of Tasmania, who had accompanied the "Aurora" on one of her trips to the Macquaries.

LIST OF SPECIES COLLECTED.

II.—POLYCHÆTA FROM COMMONWEALTH BAY.

I have been supplied by Mr. J. G. Hunter, Biologist to the expedition, with the following information as to the collection of the worms :—

" During the greater part of the year 1912 dredgings were carried out in a small boat-harbour close to winter quarters. The depth varied from 2–5 fathoms ; the bottom for the most part muddy, and dredgings yielded a considerable number of Annulates, which form the chief constituent of the fauna of these shallow waters.

" Dredging in deeper water was prevented by the abnormal weather conditions that prevailed. In these latitudes the sea generally freezes over during the winter, and then by digging channels in the ice a dredge can be lowered. The violence of the winds at Adelie Land, however, prevented the sea from freezing, excepting at the beginning of September, 1912, when, during a calm lasting for several days, the sea froze sufficiently to allow of dredging operations. And so, on the 3rd and 4th of that month, rich hauls were made in depths from 15–30 fathoms.

" While the 'Aurora' was anchored in Commonwealth Bay, several dredgings were made with a small hand-dredge—(*a*) on 20th January, 1913, in 15–20 fathoms ; (*b*) on 14th December of the same year, in 45–50 fathoms ; and (*c*) on 21st of the month, in 55–60 fathoms.

"During the summer cruise, Mr. J. G. Hunter, assisted by Mr. H. Hamilton, a number of dredgings were taken in deeper waters, the 'Aurora' being specially fitted for this purpose."

In addition, some tow-netting was done in the bay.

The list of stations and the details of the hauls follow. A total of forty-seven species were obtained at these stations, the majority of which, as would be expected, are already known; but I have found it necessary to establish two new species of Phyllodocids of the sub-genus *Pterocirrus*, namely, *Eulalia* (*Pterocirrus*) *hunteri* and *Eulalia* (*Pterocirrus*) *mcleani*: as well as a new species of *Exogone*, and of *Scoloplos*, and a new variety of *Aricia marginata*, in which the arrangement of the spines in the anterior segments presents a condition recalling that occurring in *A. ohlini* Ehlers.

Further, a new species of the Ampharetid *Phyllocomus*, hitherto represented only by *P. crocea* Grube, exhibits a form of gill unique in the family. While a new genus in the same family seems needed for a species which possesses an entirely novel kind of tentacular apparatus in the form of a folded and introversible membrane in place of the usual filamentous tentacles. I have named this worm *Amythas membranifera*.

The collection is also of interest in that it contains as many as three specimens of the rare *Nereis loxechini* Kinberg, of which only three individuals have hitherto been recorded.

Tomopteris carpenteri Quatrefages, so long unrecognised, is also represented, and is fully described; and a northern species, *T. septentrionalis* Quatrefages, is included in the collection. Certain other species hitherto found only outside the Antarctic region must now be included in that fauna, namely, *Eulagisca corrientis* McIntosh, and *Eunoa abyssorum* McIntosh.

In the total number of species submitted to me, and therefore presumably collected by the "Aurora," the present compares favourably with the number taken by previous expeditions, other than the "Gauss," which was an extremely rich collection.

One cannot help being struck with the enormous quantity of some of the species living at the sea-bottom in these cold seas. Thus in this collection I find in a single haul more than 100 individuals of *Thelepus antarcticus*; again, sixty-five individuals of *Harmothoe spinosa* were obtained at one haul; and of *Potamilla antarctica* as many as forty were brought up in the dredge at one spot.

This abundance of individuals may be due in part to the scarcity of enemies and in part to the fact that the conditions, although so apparently severe, must in reality be very favourable for their existence.

GATHERINGS FROM THE VARIOUS STATIONS.

1. Adelie Land.

Boat Harbour, Commonwealth Bay, Adelie Land. Lat. 67° South. Long. 142° 36′ East.

A.—2–5 fathoms. Collected by Dr. A. L. McLean :—

Syllis closterobranchia.
Pionosyllis comosa.
Sphærosyllis mcintoshi.
Exogone anomalochæta.
Autolytus charcoti.
Harmothoe spinosa.
Harmothoe tuberosa.
Nephthys macrura.
Ophryotrocha claparedi.
Aricia marginata.
Scoloplos mawsoni.
Cirratulus cirratus.
Terebella ehlersi.
Terebella vayssieri.
Ereutho antarctica.
Isomastus perarmatus.
Rhodine intermedia.
Spirorbis nordenskjoldi.

B.—Boat Harbour, 25–30 fathoms (3rd and 4th September, 1912) :—

Harmothoe tuberosa.
Phyllodoce madeirensis.
Nephthys macrura.
Aricia marginata var. *mcleani.*
Terebella ehlersi.
Thelepus antarcticus.
Potamilla antarctica.
Serpula vermicularis var. *narconenis.*

C.—Commonwealth Bay, 15–20 fathoms (20th January, 1913) :—

Syllis closterobranchia.
Harmothoe spinosa.
Harmothoe tuberosa.
Terebella ehlersi.
Thelepus antarcticus.
Leana arenilega.

D.—Commonwealth Bay, 45–50 fathoms (14th December, 1913) :—

Syllis closterobranchia.
Tryanosyllis gigantea.
Harmothoe spinosa.
Harmothoe tuberosa.
Enipo rhombigera.
Phyllodoce madeirensis.
Terebella ehlersi.

E.—Commonwealth Bay, 55–60 fathoms (21st December, 1913) :—

Harmothoe spinosa.
Harmothoe tuberosa.
Enipo rhombigera.
Terebella ehlersi.

SUMMER CRUISE, 1913–1914.

Station 1.—Lat. 66° 50′ South. Long. 142° 6′ East. Depth, 350–400 fathoms. Temperature, — 1·84° Cent. Bottom, thick ooze. (22nd December, 1913.)

Trypanosyllis gigantea.
Harmothoe spinosa.
Harmothoe tuberosa.
Hermadion rouchi.
Enipo rhombigera.
Pterocirrus mcleani.
Serpula vermicularis var. *narconensis.*

Station 2.—Lat. 66° 55′ South. Long. 145° 21′ East. Depth, 318 fathoms. Temperature, — 1·8° Cent. Bottom, ooze. (28th December, 1913.)

Trypanosyllis gigantea.
Enipo rhombigera.
Eulalia charcoti.
Nereis loxechini.
Glycera capitata.
Aricia marginata.
Scione mirabilis.
Serpula vermicularis var. *narconensis.*

Station 3.—Lat. 66° 32′ South. Long. 141° 39′ East. Depth, 157 fathoms. Temperature, — 1·62° Cent. Bottom, ooze. (31st December, 1913.)

Syllis closterobranchia.
Lætmonice producta.
Harmothoe spinosa.
Harmothoe tuberosa.
Enipo rhombigera.

Eulalia charcoti.
Nereis loxechini.
Nephthys macrura.
Isocirrus yungi.
Amphitrite kerguelensis.
Phyllocomus dibranchiata.
Potamilla antarctica.

Stations 4, 5 and 6 yielded no Polychætes.

Station 7.—Lat. 65° 42′ South. Long. 92° 10′ East. Depth, 60 fathoms. Temperature not taken. Bottom, red Algæ, and a few small rocks, and various forms of animal life; no ooze. (1st January, 1914.)

Vanadis antarctica.
Potamilla antarctica.

Station 8.—Lat. 66° 8′ South. Long. 94° 17′ East. Depth, 120 fathoms. Temperature not taken. Bottom, small granitic rocks; no ooze. (27th January, 1914.)

Harmothoe spinosa.
Harmothoe tuberosa.
Eulagisca corrientis.
Enipo rhombigera.
Phyllodoce madeirensis.
Eulalia charcoti.
Scione mirabilis.
Potamilla antarctica.
Serpula vermicularis var. *narconensis.*

Station 9.—Lat. 65° 20′ South. Long. 95° 27′ East. Depth, 240 fathoms. Temperature, +1·38° Cent. Bottom, granitic pebbles, with small amount of ooze. (28th January, 1914.)

Serpula vermicularis var. *narconensis.*

Station 10.—Lat. 65° 6′ South. Long. 96° 13′ East. Depth, 325 fathoms. Temperature, — 1·65° Cent. Bottom, ooze. (29th January, 1914.)

Harmothoe spinosa.
H. (Eunoa) abyssorum.
Enipo rhombigera.
Hermadion rouchi.
Nereis loxechini.
Lumbriconereis magalhaensis.
Flabelligera mundata.
Amythas membranifera.
Serpula vermicularis var. *narconensis.*

Station 11.—Lat. 64° 44′ South. Long. 97° 28′ East. Depth, 358 fathoms. Temperature not taken. Bottom, ooze. (31st January, 1914.)

Lætmonice producta.
Harmothoe (Eunoa) abyssorum.

Station 12.—Lat. 64° 32′ South. Long. 97° 20′ East. Depth, 110 fathoms. Temperature not taken. Bottom, rock. (31st January, 1914.)

Harmothoe spinosa.
H. (Eunoa) abyssorum.
Hermadion rouchi.
Enipo rhombigera.
Eulalia charcoti.
Pterocirrus hunteri.
Nephthys macrura.
Glycera capitata.
Flabelligera mundata.
Scione mirabilis.
Potamilla antarctica.

Station 13.—Depth, 1,800 fathoms. No worms were taken.

Surface Tow-netting.

Boat Harbour.—By Dr. A. L. McLean.

Autolytus charcoti (1912).
Vanadis antarctica (1913).

On edge of pack-ice.

Pelagobia viguieri, in 45–100 fathoms. (6th and 10th January, 1914.)
Tomopteris septentrionalis, in 45–100 fathoms. (6th and 10th January, 1914.)
Tomopteris carpenteri, in 30–45 fathoms. (January, 1914.)

Summary of Results.

It seems unnecessary to give tabular statements of the faunistic relations of these Antarctic species, for this has been done by Gravier, and in greater elaboration by Ehlers in his magnificent and exhaustive report of the German expedition (1913).

But a summary of the results in regard to each of the families represented in this collection may be useful.

Family SYLLIDÆ.

Twenty-one species of this family have been recorded from the Antarctic region, but the present collection contains only five of them. Owing, no doubt, to their small size, these worms are likely to be overlooked unless great care be taken in sorting out the material.

Of the six species in the collection, *Exogone anomalochæta* is new; which with *Autolytus charcoti* and *Pionosyllis comosa* is limited, so far as is known, to the region. The atokous and both sexes in the epitokous phases of Autolytus were met with. *Sphærosyllis mcintoshi* passes northwards beyond this region to Kerguelen and South Georgia. *Trypanosyllis gigantea* occurs in the Magellan area, and *Syllis closterobranchia* passes beyond the Sub-antarctic region into the Southern Temperate zone to West Africa and to New Zealand.

Family APHRODITIDÆ.

Hitherto twelve species have been noted as occurring in the Antarctic, of which five are found in the present collection, and two additional species are to be recorded as entering the region. Of these seven species *Enipo rhombigera, Hermadion rouchi* and *Harmothoe tuberosa* are confined to the region. *H. spinosa*, a very common worm here, is also met with in the sub-antarctic area. *Lætmonice producta* is the most widely distributed, passing northwards in the Atlantic to the West Coast of Ireland, and up through the Pacific to the Japan coast.

The two additions to the Antarctic fauna are *Eunoa abyssorum*, which is known elsewhere only in deep water to the south east of Australia ; and *Eulagisca corrientis* ranges up the east coast of South America as far as Buenos Ayres.

Family PHYLLODOCIDÆ.

This family is represented in the region by sixteen species, three of which occur in the "Aurora" gatherings. Of these *Eulalia charcoti*, *Eteone regi*, and *Pelagobia viguieri* are confined to the Antarctic ; and two new species have to be added to the list, namely, *Pterocirrus Mclcani*, and *Pt. hunteri*. The fifth is *Phyllococe madeirensis*, whose specific name would scarcely lead us to expect it in these waters, yet it has already been recorded from Cape Adare as well as from South Georgia and Juan Fernandez. Fauvel has suggested, in explanation of the wide distribution of this and some other species, that it descends in the equatorial regions to great depths, and passing southwards reappears in the colder waters at less depths.

Family ALCIOPIDÆ.

The only species observed is *Vanadis antarctica*, which has a world-wide range through the oceans, as one would expect from its pelagic habit.

Family TOMOPTERIDÆ.

The only species which have been collected in Antarctic seas are the two species included in the present report, namely, *T. carpenteri*, the history of which will be found detailed in the systematic portion, and *T. septentrionalis*, which has recently been recorded by Gravier from the Weddell Quadrant.

Family NEREIDÆ.

As in other expeditions, this family was found but sparsely in the Antarctic; indeed, until 1908, the only species that had been met with was *N. loxechini*, which Kinberg had originally described from the Magellan Strait, but which in recent years has been recorded from the deep water to the east of Island of St. Paul, and from the winter quarters of the "Gauss." But Ehlers found amongst the "Valdivia" worms *Nereis uncinata* from near Bouvet Island. The "Aurora" did not meet with it.

Family NEPHTHYDIDÆ.

In addition to *N. macrura*, which is a Sub-antarctic form entering the Antarctic region, *N. abranchiata*, has been recorded from the region by Ehlers (1913).

Family EUNICIDÆ.

The Eunicids scarcely enter the Antarctic, for only two species have ever been recorded, both of which are included in the present collection. *Lumbriconereis magalhaensis* is a typically Sub-antarctic form, and only one specimen was gathered in Commonwealth Bay. The small pelagic *Ophryotrocha claparedi* was however extremely abundant in Boat Harbour; it has already been gathered elsewhere, though recorded under the title of *Paractius notialis*.

Family GLYCERIDÆ.

Glycera capitata, originally described from the European seas, is the only member of the family that appears to enter the region under consideration. It has been met with by each of the expeditions.

Family ARICIIDÆ.

Hitherto only three species belonging to the family have been described from the Antarctic region. One of these, *Aricia marginata*, is included in the present collection. A new species, *Scoloplos mawsoni*, is necessary for a worm that differs from *S. kerguelensis*, which has been recorded by the French Expedition, but which is characteristically a Sub-antarctic form.

Family CIRRATULIDÆ.

The Cirratulids are also very rare in the region; only one species has been definitely determined, though Ehlers found certain worms which he names generically without giving specific names to them. This sole species is the European *Cirratulus cirratus*, hitherto known from the Magellan Strait and elsewhere in the south under Ehlers's title, *Promenia fulgida*, which Fauvel has shown to be a *nomen nudun*.

Family TEREBELLIDÆ.

The Antarctic is a favourable habitat for members of the family, as each expedition adds one or more to the species already known. Of the twenty-four that have been recorded the "Aurora" obtained seven off Adelie Land. Of these, three

appear to be confined to the Antarctic region, namely, *Terebella ehlersi*, *T. vayssieri*, and *Leœna arenilega*. The others enter the sub-antarctic region at Kerguelen and Tierra del Fuego, &c., while the seventh *Scione mirabilis* (which, as I show, includes *S. spinifera* Ehlers) travels up both coasts of South America into the southern temperate zone.

Family AMPHARETIDÆ.

Six species of this family have been gathered by previous expeditions within this area; the present report contains an account of only two species, both of them new, as I have mentioned earlier in the memoir. These are *Phyllocomus dibranchiata* and *Amythas* (gen. nov.) *membranifera*.

Family CAPITELLIDÆ.

It has been stated that this family does not enter the Antarctic region, but Gravier has recorded one species, *Isomastus perarmatus* from the Weddell Quadrant, and this has also been obtained by the "Aurora."

Family MALDANIDÆ.

The Swedish expedition has added materially to our knowledge of the family, as it exists in this region so that seven well characterised species and some varieties are known, as well as three unspecified forms recorded by Ehlers. The "Aurora" gathered two of the species, both of which are confined to this region, namely, *Rhodine intermedia* (hitherto confused with the northern *R. loveni*) and *Isocirrus yungi*, originally discovered at Petermann Island.

Family CHLORHÆMIDÆ.

Of the six species of *Flabelligera* reported from the Antarctic only one is included in this collection (*F. mundata*), which is wide-spread round the southern land-mass. The only other member of the family that has been mentioned is *Trophonia kerguelarum* Grube, as having been obtained by the "Discovery" at winter quarters, but no reference to this locality is made in Ehlers in his later works, though it is sub-antarctic in its distribution.

Family SABELLIDÆ.

Nine species have been recorded from this region, of which four are quite small and have been obtained only by the "Gauss." The only species collected by the "Aurora" is *Potamilla antarctica,* which occurs in considerable numbers, and sometimes attains a large size. It also enters the Sub-antarctic region.

Family SERPULIDÆ.

Two of the ten species known to occur in the Antarctic are contained in this collection—the widely distributed *Serpula vermicularis* and *Spirorbis nordenskjoldi.*

2. Macquarie Island.

This island has not hitherto been explored for Polychæta, but thanks to the industry and care of Mr. H. Hamilton during the nearly two years he sojourned here, I can put on record fifteen species of which three are new: *Lumbriconereis macquariensis*, *Sphærodorum spissum* and *Polycirrus hamiltoni*. All the other species are typically sub-antarctic in character, and have been recorded either from the southern outliers of New Zealand or from the Kerguelen or Falkland Islands. They were all collected in rock pools or under stones or rocks along the shore.

Syllis closterobranchia.
Syllis brachycola.
Exogone anomalochæta.
Eulalia magalhaensis.
Nereis kerguelensis.
Nereis australis (= *magalhaensis*).
Lumbriconereis magalhaensis.
Lumbriconereis macquariensis.
Sphærodorum spissum.
Cirratulus cirratus.
Thelepus setosus.
Leprea streptochæta.
Polycirrus hamiltoni.
Arenicola assimils var. *affinis.*
Potamilla antarctica (small forms).

3. Maria Island, Tasmania.

Five species were obtained in the two trawls put down by Professor Flynn. Of these one is new, and belongs to a Polynoid genus, *Hololepidella*, established by Willey for a Ceylon species. Two of the other species obtained have already been reported from the neighbourhood ; the remaining couple are widely distributed.

Hololepidella flynni (from 1,300 fathoms).
Physalidonotus rugosus (from 65 fathoms).
Lætmonice producta var. *benthaliana* (from 1,300 fathoms).
Eunice tentaculata (from 65 fathoms).
Eurythoe complanata.

SYSTEMATIC ACCOUNT.

Family SYLLIDÆ.

Sub-family SYLLIDEÆ.

Genus SYLLIS *Savigny*.

SYLLIS CLOSTEROBRANCHIA *Schmarda.*

Schmarda (1861), p. 72.
Ehlers (1904), p. 19, pl. III, figs. 1–4.
Ehlers (1908), p. 45.
Benham (1909), p. 237.
Ehlers (1913), p. 476, pl. XXXI, figs. 1–3 (epitokous phases).
Augener (1913), p. 200, fig. 23. (I have not seen this.)
Fauvel (1919), p. 354.

(Plate 5, figs. 1–2.)

It is interesting to find this species, originally regarded as a Sub-antarctic form, occurring off Adelie Land, though it has already been recorded from Kaiser Wilhelm II Land.

Amongst the material I find epitokous phases as well as the atokous. The species seems somewhat variable, judging from the accounts of Ehlers and Fauvel, and my own observations, especially in regard to the shape and length of, and the number of annuli in, the dorsal cirri. I will here refer only to such differences as I have noted, for on the whole the specimens agree with the previous accounts.

The larger individuals in the present collection, which numbers about a score, measure from 20-25 mm. in length, with a width of 1 mm.; they contain from 60-100 segments. The breadth of the body is fairly uniform throughout, except for a slight tapering at each end. There are no markings on the dorsal surface.

The prostomium is not quite in agreement with Ehlers's figure, for in the specimens before me it is transversely oval, with the anterior margin produced in the middle line to form a rounded lobe, which is about half the width of the base of the prostomium. Ehlers shows the margin to be a continuous curve. The difference is perhaps due to the state of preservation.

The number of annuli in the cirri has been shown to vary, and Ehlers (1913) has found that in the youngest stages they are not moniliform; and that the annulation increases with age; but I suggest that the differences observed in various adults may be in part due to injury to the tips of the appendages.

The median prostomial tentacles in the present specimens have 16 annuli; the laterals 12; the dorsal peristomial cirri present 17–18; the ventrals 15 (Ehlers found in a specimen from the Chatham Islands as many as 21-23 respectively).

The dorsal cirri have a spindle-shape outline, which is characteristic for the species; the cirri of the anterior six to eight segments are longer than the rest; their length is greater than the breadth of the body here; the sixth being the longest; it has 20 annuli.

The remainder of the dorsal cirri are fairly uniform in length, but not absolutely so; though this seems to me due to inequality in contraction.

The length of these cirri over the greater part of the body is rather less than the breadth of the body; I find 12–13 annuli in most of them. Ehlers gives 8–11, usually the latter, and in specimens from the Chatham Islands as many as 21. Fauvel gives 10–15 for Red Sea specimens.

I find (fig. 1) that each parapod is supported by 3 or even 4 acicula, which lie close to one another above the bundle of chætæ. The end of each aciculum is dilated just below the blunt tip, which is obliquely truncated and projects from the surface. (fig. 2). In some individuals, however, there is no dilatation, and the apex is symmetrically pointed.

The pharynx commences in the 4th chætigerous segment, as is seen in a specimen mounted entire in glycerine; it extends back to the tenth segment, where it enters the "stomach" (or "ventriculus") which occupies segments 11–18; the intestine at first passes forwards from this point, and then bends backwards. It is from the former region that the pair of long cylindrical cæca are given off, one of which reaches forwards into the 14th, the other only as far as the 15th segment.

Epitokous Phases.

A male and a female occur amongst the material gathered at Boat Harbour at $3\frac{1}{2}$ fathoms.

They measure 12 mm. in length, with a width of 1 mm., and contain about 32 segments. The eyes are large and red. They agree generally with the account and figures given by Ehlers.

I note, however, that four eyes are present in both sexes, one pair on the dorsal, the other pair on the ventral surface. Ehlers figure shows the male to be blind.

The prostomial tentacles of the male are longer than in the female, but are not moniliform in either sex.

The male is entire, and possesses two long moniliform anal cirri, longer than the dorsal cirri of that region. In the male the long modified chæta commence in the third chætigerous segment, in the female in the second.

Ehlers notes that the spawning time occurs in December and January. These were gathered in the former month.

Localities.—

Commonwealth Bay, Boat Harbour, 2–4 fathoms. Collected by Dr. A. L. McLean. Commonwealth Bay, Station C. 15–20 fathoms; Station D. 45–50 fathoms; Station 3, 157 fathoms.

Macquarie Island, Rock pools, coll. Mr. Hamilton.

Distribution.—Cape of Good Hope (Schmarda), Angra Pequena, New Zealand, Chatham Islands, Kaiser Wilhelm II Land (Ehlers), Campbell Island, Antipodes Islands (Benham), Red Sea (Fauvel*).

SYLLIS BRACHYCOLA *Ehlers.*

Ehlers (1897), p. 38, pl. II, figs. 46, 47.
Gravier (1906), p. 20, pl. II, fig. 17.
Ehlers (1913), p. 477.
Fauvel (1916), p. 427.

(Plate 5, fig. 3.)

Several of this species were obtained, and I may note the form of the acicula, of which two or three occur in each parapod. They may be colourless or brown, but have a characteristic extremity. This is a rounded knob quite unlike those of *S. closterobranchia* (fig. 3).

The uppermost chæta, which is capilliform ("Nadel" of Ehlers), does not make its appearance till about the 20th foot, and may even be absent from some of the posterior feet, though whether they are broken or not developed I cannot say.

Locality.—

Macquarie Islands. Scrapings off kelp.

Distribution.—Magellan, Kerguelen, South Georgia, Kaiser Wilhelm II Land (Ehlers), Booth Wandel Island (Gravier), Falkland Islands (Fauvel).

Genus PIONOSYLLIS *Malmgren.*

PIONOSYLLIS COMOSA *Gravier.*

Gravier (1906), p. 15, pl. II, figs. 12, 13.
Gravier (1911), p. 49.
Ehlers (1913), p. 473, pl. XXXII, figs. 1–4.

Several fragments of this Antarctic worm, consisting of the head and some 20 chætigerous segments, were obtained. They measure 25 mm. in length and about 0·5 mm. across. Some are ripe females filled with eggs as far forwards as the proventriculus, but they present no epitokous modifications.

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* It may here be noted that Fauvel (1917, p. 193) regards the variety of *Syllis closterobranchia* from the Chatham Islands (Ehlers), a specimen of which he has found on the coast of South Australia, as identical with *S. hyalina* Grube.

The freedom of the palps is well seen in those in which the pharynx is protruded, when they become widely separated, as is shown in Ehlers's figures.

The eyes are not so large as he figures, and I find that the anterior pair are, as usual, larger than the posterior.

The chætæ of the anterior segments are all alike, but further back the length of the appendix differs in the upper and lower members of the bundle, but not I think to so great an extent as is indicated by Gravier's figures.

Locality.—

Commonwealth Bay.

Distribution.—Port Charcot, Port Circoncision (Gravier), Kaiser Wilhelm II Land (Ehlers).

Genus TRYPANOSYLLIS *Claparède.*

TRYPANOSYLLIS GIGANTEA *McIntosh.*

Syllis gigantea McIntosh (1885), p. 193, pl. XXX, figs. 1–3; pl. XXXIII, fig. 4; pl. XA, fig. 10; pl. XXXIV A, fig. 7.

Trypanosyllis gigantea Ehlers (1897), p. 35.

Trypanosyllis gigantea Ehlers (1901), p. 85.

Trypanosyllis gigantea Ehlers (1908), p. 65.

Trypanosyllis gigantea Ehlers (1912), p. 17.

Trypanosyllis gigantea Ehlers (1913), p. 475, pl. XXXI, figs. 11–16.

Trypanosyllis gigantea Gravier (1911), p. 52, pl. I, figs. 7, 8.

Trypanosyllis gigantea Fauvel (1917), p. 200, gives further synonymy.

This characteristic Antarctic Syllid is evidently very abundant in Commonwealth Bay, for there are at least twenty individuals in the collection obtained from five stations or perhaps from four, as one of the lots consisting of as many as fourteen specimens is accompanied by no information as to where they were obtained.

Some of the specimens attain to a greater size than even those described by McIntosh, which reached only the length of 60 mm. The largest complete individual in the present collection measures 130 mm., with a diameter of 5 mm. over the body, and 6 mm. across the parapodia. The width of the body is equal to the length of twelve segments, which are thus very short. The body is very much depressed, its height being only 2 mm. McIntosh gives a figure of a transverse section through the pharyngeal region, where the height of the body is increased by the presence of that organ; the worm is in reality much flatter than that figure would indicate.

The colour of the preserved specimens is a pale yellow, dorsally and ventrally, becoming brownish anteriorly. One individual is orange brown ventrally, with a yellowish dorsum, and with brown markings along the margins of this surface.

The tentacles are white; the dorsal cirri are alternately plain white, and white ringed with purplish brown. In some specimens these white cirri are more closely coiled than the others, and lie close to the body forming a fringe, as it were, along its margin. The purple-ringed cirri, however, are more loosely coiled, and they rise above the level of the former, over the back of the worm. The two series of cirri are thus very readily distinguished. All the cirri, like the tentacles, are moniliform.

Ehlers (1897) states that when alive, the colour of the worms from South Georgia were " a beautiful orange, with white belly ;" those from Magellan Strait were rosy-red, with dark brownish-red cirri; or pale flesh-coloured, with cirri of the same tint; or dark brown. The former plan of colouration seems to agree with those from Commonwealth Bay. He also notes (1911) that in February and March the species develop swimming bristles, so that presumably they become sexually mature at this period.

Localities.—

Commonwealth Bay, Station D, 45–50 fathoms,
Station 1, 350–400 fathoms,
Station 2, 318 fathoms,
Station 12, 110 fathoms,

**Distribution.*—Kerguelen (McIntosh), South Georgia, Magellan Strait, Juan Fernandez, Kaiser Wilhelm II Land, South Victoria Land (Ehlers), Marguerite Bay, Terre Alexandre (Gravier).

Sub-family EXOGONEÆ.

Genus EXOGONE *Oersted.*

EXOGONE ANOMALOCHÆTA *sp. nov.*

(Plate 5, figs. 11–13.)

Several small worms, measuring about 6 mm. in length, with about 36 segments, agree pretty closely with *E. heterosetosa* McIntosh, so that it is unnecessary to give a detailed account of them. Nevertheless, there are two differences from that species which render it necessary to establish a new one.

The tentacles spring close to the anterior margin of the prostomium, and in this respect differs from the above species. (See Ehlers, 1897, pl. III, fig. 61.) They are unequal in size; the median is spindle-shaped, shorter than the length of the postomium; the laterals are ovate and shorter than the median.

The peristomium bears a short ovate cirrus, and just above it a nuchal organ, such as Gravier figures for *E. turqueti* (1906, pl. I, fig. 3). The huge palps are longer than the prostomium. The anal cirri are spindle-shaped, and equal in length the anal segment.

* If Fauvel is correct in identifying the species with *Syllis tæniæformis* Haswell, and with *T. richardi* Gravier, the further localities must be added—Australia, North and South Atlantic, Red Sea, Persian Gulf.

The parapodia spring from near the anterior boundary of the segments, are short, and contain but few chætæ—about 6 in the anterior and 4 in the posterior feet.

There are three kinds of chætæ (fig. 13)—(*a*) the uppermost simple capilliform, swollen at the end with a symmetrical but fine point (this is the "aciculum" of McIntosh); (*b*) the uppermost gomphotrich, which differs from that found in *E. heterosetosa*, as will be described below; and (*c*) some four or five smaller gomphotrichs. These have an enlarged end to the shaft and articulated deep down at one side is the short bidentate appendix. They are similar to those in *E. heterosetosa*, but have a more swollen cup. The lowest chætæ have this somewhat less enlarged than the upper ones, but the difference between them is not very marked.

The uppermost gomphotrich is not "spathulate" at its extremity. It consists of a slender shaft, which is much expanded at its extremity to form a large cup, which when seen from the side is quadrate. Three of its sides or edges are smooth, and in the re-entering angle between two of these the appendix is articulated, the fourth side forming the real free end of the shaft is finely but sharply denticulate, and its face is striated. The appendix is rather long, curved, and bidentate.

When seen in the other plane—that is, from the front—the swollen end of the shaft is oval, and the free tip of the appendix projects beyond. It has somewhat the appearance of Ehlers's figure of the chæta of *E. heterosetosa* (1897, pl. III, fig. 65), if a line were drawn between the pointed tip and the oval portion; but there are no concentric lines here in the present species. The previous authors, McIntosh, Ehlers, Gravier, have stated that this particular chæta is "simple" and "spathulate." But in a recent paper Fauvel (1919, p. 356) states that it is really a gomphotrich, i.e. that it bears a long and delicate appendix ("arête") which, being easily broken off, gives the appearance of being simple. But, even so, the form of the chæta in the worms before me differ so much from the figures that I cannot correlate the two, hence the new species.

It differs from *E. clavator* Ehlers, in the absence of the chætæ with very long appendices that occur in the upper part of the bundle, as well as in other characters; and from *E. turqueti* Gravier, also in the form of the chætæ.

The dorsal cirrus is ovate and shorter than the chætigerous lobe; the ventral cirrus is longer, pointed, and extends beyond the lobe.

The pharynx is lined with a dark-brown cuticle and extends through the peristomium and three following segments to enter the barrel-shaped proventriculus, which occupies $2\frac{1}{2}$ segments. This leads into a sub-globular region occupying the rest of the 7th segment, and then follows the intestine.

Locality.—

Commonwealth Bay and Macquarie Island.

Amongst some material sorted out by Professor Haswell he noted some individuals bearing young ones, which he kindly forwarded to me. The young ones are carried on each side of the ventral surface just below the ventral cirri. They form a double series of 8 or 9 on each side of the segments 12–20.

Each young one consists of head and 4 chætigerous segments, followed by one segment with a parapod, but without chætæ, and the anal segment carries a pair of long cirri.

Owing to the position of the mother, I am unable to see the characteristic gomphotrich, but as the specimens come from the same locality I have little doubt that it is this species.

Genus Sphærosyllis *Malmgren.*

Sphærosyllis McIntoshi *Ehlers.*

Salvatoria kerguelensis McIntosh (1885), p. 188, pl. XXX, fig. 4; pl. XXXIII, fig. 1; pl. XV A, figs. 11, 12.
Sphærosyllis mcintoshi Ehlers (1897), p. 46.
Sphærosyllis mcintoshi Ehlers (1913), p. 481.

(Plate 1, figs. 4–6.)

Ehlers has laready shown that *Salvatoria* of McIntosh is in reality a Syllid belonging to Malmgren's genus. McIntosh, although he placed the worm amongst the Hesionidæ, recognised in the course of his account that in several features it approached the Syllidæ.

In the present collection I find specimens of this small worm amongst those taken in Boat Harbour during the month of June, 1912, in 3–4 fathoms of water.

They are only 3–4 mm. in length with 28–33 segments. The tentacles and the dorsal cirri have swollen bases and narrowed tips, but are not so short and stumpy as in the typical *Sphærosyllis*. The rounded prostomium (figs. 4, 5) carries three tentacles, two pairs of eyes, and a pair of palps; the last are fused and project beyond the prostomium. Ventrally this region is deeply furrowed in the median line indicating the double nature of this organ. McIntosh, it will be remembered, denied the existence of the palps; but his specimens were soft and ill-preserved.

He was, I think, in error too in stating that the filamentous tapering extremity of tentacle and cirrus is " distinctly segmented," for in my specimens, which are well preserved, there is no indication of this, though there are a few quite irregularly disposed constrictions along this region, when the animal is mounted in glycerine.

I have thought it well to give a careful drawing of the head (fig. 4) as McIntosh's figure, the only one as far as I know that has been published, is misleading.

The peristomial cirri are short. The following segments carry long parapods, each with a single bundle of chætæ, a dorsal cirrus, and a short cylindrical ventral cirrus which extends beyond the chætigerous lobe.

The chætigerous lobe is supported by two acicula, each of which is swollen just below the point (fig. 6). Below these are 8–10 chætæ, the uppermost of which is capilliform, as McIntosh has noted, while the rest are gomphotrichs of the form shown in his figure.

The anal segment carries a pair of cirri similar to the dorsal cirri.

The extent of the pharynx and the proventriculus (or stomach) agrees with that shown in his figure.

I received some specimens from Dr. Haswell in which eggs were attached to the parapods.

Ehlers has described the epitokous phase.

Locality.—

Boat Harbour, Commonwealth Bay, 3–4 fathoms.

Distribution.—Kerguelen (McIntosh), South Georgia, Kaiser Wilhelm II Land (Ehlers).

Sub-family AUTOLYTEÆ.

Genus AUTOLYTUS *Grube.*

AUTOLYTUS CHARCOTI *Gravier.*

Gravier (1906), p. 7, pl. I, figs. 1, 2.

(Plate 5, figs. 7–10.)

Of this species, both the atokous and the epitokous phases of both sex are represented ; the latter have not hitherto been described.

Atokous phase.

Of the seven specimens of the atokous phase in the collection, some were still within thin transparent membranous tubes ; of which one measures 30 mm. in length and 4 mm. in diameter. The tubes were attached to one another, side by side, forming a small mass; and to one was attached a portion of a colony of a Hydrozoon.

The contained animal is complete and measures 26 mm. in length, with a breadth of 3 mm. at about $\frac{1}{3}$rd of its length, whence it tapers slightly both anteriorly and posteriorly; it contains 70 segments. The body is flattened dorso-ventrally and has height of 2 mm. (fig. 7). Another individual, from Boat Harbour, was free from its tube ; is 18 mm. in length and 1·5 mm. across the body, which is built up of 68 segments or more, the last few being very small. Smaller worms were also present, one of which with a length of 6 mm. was stained and mounted entire. It is still within its thin tube and came from the same station in Commonwealth Bay as that first mentioned.

Gravier had only two specimens, one of which was entire, and is smaller than some of those before me.

The worms are pale-brown in colour with a transverse bar of somewhat darker tint across each segment, the width of the bars being rather greater than the pale space separating them. As Gravier has noted, this banding is more marked towards the middle of the body length.

The first mentioned worm is full of eggs, though the body is not yet differentiated into regions ; there are none of the characteristic long slender bristles that indicate the epitokous phase.

Passing backwards from the prostomium are two conspicuous white broad ridges, the " epaulettes " or " ailerons," which cross over the peristomium and two following segments just above the bases of the dorsal cirri and end at the hinder margin of the third segment. Each of these structures is grooved along its upper surface, and its inner margin is thickened, rounded, and opaque white; they show well against the pigmented surface of the dorsal surface. Though so conspicuous in the worm viewed by reflected light, they are scarcely visible in a stained specimen mounted in Canada balsam.

The peristomial dorsal cirri are about as long as the prostomial tentacles. The ventral cirri of this segment are short. On the next two segments the dorsal cirri are longer still, though their exact length is difficult to estimate as they are coiled.

The dorsal cirri are cylindrical, smooth, and though presenting irregular constrictions here and there, are not truly moniliform; each is marked by a streak of brown pigment along its external and internal faces.

On the ventral surface there is, on each side, a series of segmentally arranged great oval glandular pads such as McIntosh describes for his *Autolytus maclearanus*. I suggest that these glands are responsible for the membranous tube in which the worm lives.

The anterior dorsal cirri are as long as the width of the body, but decreases in length posteriorly, so that in the mid-body, their length is about half this width, and they become still shorter further back.

The form of the parapod (fig. 7), and the arrangement of the chætæ are as Gravier has described, though the ventral glandular pad is more definitely constricted off from the body on the ventral surface than his figure indicates. The parapod is supported by a couple of acicula lying close together side by side ; and carries, besides the bundle of compound chætæ, one or two capilliforms ; it is, however, only exceptionally that one can detect them owing to their fragility.

The cup of the " gomphotrich " or compound chæta (fig. 8), is characteristically striated on one side, the appendix is, as usual, short with two unequal teeth, of which the distal is slenderer than the other; the latter presents slight differences according to its position in the bundle ; in the lower chætæ it is sharply pointed as is the distal tooth; whereas in the upper ones it is usually bluntly rounded as if subject to wear. The form of the appendix does not quite agree with the figure given by Gravier (p. 8, fig. 1), as I find that there are no serrations below the teeth. It seems also to be somewhat broader in proportion to the length than is shown by that figure.

The pharynx, which Gravier was unable to study, extends back to the end of the 7th segment, where it bends forwards on itself, then turns back to enter the " stomach " (or proventriculus), which occupies apparently segments 10–14 as seen in a specimen that I dissected; but in a mounted specimen of smaller size, this stomach occupies segments 7–10. Whether this difference is due to age or to a disarrangement during dissection I cannot say.

Remarks.—From these southern seas, four species of Autolytus have been recorded—*A. maclearanus* McIntosh, *A. gibber* Ehlers, *A. simplex* Ehlers; in addition to Gravier's species. But the last is the only one in which the "ailerons" are developed, as Ehlers has pointed out (1913).

Epitokous phases.

A considerable number, some 3–4 dozen, of male and female epitokous stages were collected on the surface at Boat Harbour. They are described by Dr. McLean as being "reddish in colour." In the preserved state some are deep brown, others pale brown, and others again almost white; they all agree in their structure though it may be that the darker ones are older than the rest*.

The brown ones are of deeper tint on the ventral than on the dorsal surface, which suggests that the worms swim on their backs at this time. Naturally they vary in length, the majority being from 12–18 mm. In each case I have chosen for description one of the largest specimens.

Sacconereis.

The majority of the females have lost the ventral egg-sac, though this is still present in one that was mounted, where it lies behind the 15th chætigerous segment.

A complete large individual, measuring 38 mm. in length with a breadth of 5 mm., consists of a "head" with 14 unmodified segments, plus 40 segments with longer parapods, each carrying a bundle of long capilliform notopodial bristles; this region is followed by 30 unmodified posterior segments.

The head in this phase undergoes little modification; there are no additional prostomial appendages; but the eyes are enlarged, specially those of the anterior pair which have become thrust down to the under surface.

The ailerons are distinct.

The dorsal surface of the body is marked by intersegmental bands of yellowish brown pigment which encroach more or less on to the surface of the segments. The dorsal cirri retain the colouration of the atokous phase, brown with a white line along each face.

Polybostrichus.

In the male, the prostomium is white, but the appendages are more or less deeply tinted. The tentacles are brown on the anterior or ventral faces, and white dorsally; the frontal tentacles, like the "bifurcated appendages," are deep brown; the dorsal cirri are paler dorsally than ventrally.

A complete individual, measuring 32 mm. in length, consists of a "head" with 14 unmodified chætigerous segments, followed by 45 segments with long capilliform bristles, behind which are again some 20 unmodified segments.

* When placed in water previous to being stained in alum-carmine the pigment is dissolved, and the water becomes coloured an orange-brown.

The transversely extended prostomium (figs. 9–10) bears the usual large eyes, arranged as in the Saccönereis. Springing from the upper surface near the hinder border is the long median tentacle, which is about 5 mm. in length. The lateral tentacles are noticeably larger, being about twice the thickness of the median and of greater length. That region of the prostomium from which they arise has apparently been pressed backwards and downwards, so that the peristomial cirri appear, in dorsal view, to be in front of them. Below the base of these long lateral tentacles is a large swollen subspherical mass overhanging the chætigerous lobe of the second segment. It is upon this mass that the lateral tentacles stand.

From the anterior margin, between the eyes, the club-shaped " frontal tentacles " arise, and below them the " bifurcated appendages " (which according to Malaquin represent the united palps and lateral-anterior tentacles, a view that Ehlers does not accept). I prefer to use the above term so as to avoid any morphological controversy. These " bifurcated appendages " consist of a thick basal region which divides into two branches, one shorter and thicker and fleshy; the other longer and slenderer. The former appears to be a continuation of the basal region (than which it is rather longer), and so to constitute the main axis; the latter branch is borne on the under and outer face of the fleshy portion; it is about ⅓rd the length of the median tentacles, but as both are coiled, it is difficult to give precise measurements.

These organs spring from the prostomium below the frontal tentacles at a level of a line drawn across between the dorsal and ventral pairs of eyes: their bases touch ventrally. Their position on what appears to be the morphological dorsal surface of the prostomium seems to negative the view that they are palps unless their origin has shifted upwards, as that of the lateral tentacles has shifted downwards.

Both the basal region of the appendage and the thicker branch are marked by a series of granular rings from which spring hairs, some of which in a mounted specimen are curved. Presumably they are sensory hairs. Unfortunately they are invisible in Canada balsam mounts, though clearly seen in glycerine preparations.

The ailerons or epaulettes are present, extending across the bases of the large tentacles and, as in the atokous phase, reach to the hinder end of the third segment.

In some specimens, but not in all, there is a linear white ridge passing backwards from the prostomium in the middle line over the first six or seven segments. I noticed it both in large and small individuals, in dark and in pale ones, while in others it is not present. I failed to detect it in the Saccönereis. Although visible in reflected light it is not to be seen in any of the mounted specimens. Has this low linear ridge anything to do with the " birnförmig Höcker," which Ehlers describes and figures for this *Pterautolytus* (1907, p. 8). This is a small pear-shaped upstanding structure on the mid-dorsal line of the 2nd segment. On p. 10, he compares it with certain " occipital Höcker " which occur in some other syllids, such as *Syllis notocera* Ehlers and *Autolytus gibber* Ehlers; in the latter, however, it is merely a broad round-edged lobe overhanging

the back of the prostomium. I have failed to find anything like this linear longitudinal ridge in any Syllids figured by Ehlers, Gravier, or other authors.

On the ventral surface, the prostomium is notched on its hinder margin and the borders are deeply pigmented. The anterior segments of the body are provided with large ventral glandular pads as in the atokous phase; and in the pale-coloured reddish individuals, these are very conspicuous owing to their opaque whiteness.

Locality of Atokous forms.—
Boat Harbour, surface $3\frac{1}{2}$ fathoms (three specimens); and Commonwealth Bay, 25 fathoms (four).

Locality of Epitokous phases.—
Boat Harbour "taken in hand-net at the surface," on 8, VII, 12; 7, IX, 12 and 14, IX, 12.

Distribution.—Port Charcot (Gravier).

Family APHRODITIDÆ.

Sub-family APHRODITINÆ.

Genus LÆTMONICE *Kinberg.*

LÆTMONICE PRODUCTA *Grube.*

Grube (1877), p. 512.
McIntosh (1885), p. 39, pl. VI, figs. 1, 2; pl. IV A, figs. 1–8.
Ehlers (1908), p. 40.
Ehlers (1913), p. 438.
Gravier (1911), p. 80.
Moore (1903), p. 420; and various other authors.

Seventeen individuals of this handsome annelid were obtained. It has been so fully described by McIntosh that nothing more need be said of it here.

Localities.—
Station 3, 157 fathoms (one).
Station 11, 358 fathoms (one).
And fifteen specimens without any data.

Distribution.—Kerguelen (Grube, McIntosh), Heard Island (McIntosh), Kaiser Wilhelm II Land (Ehlers), Graham's Land (Gravier), Japan (Moore).

L. PRODUCTA var. BENTHALIANA *McIntosh.*

McIntosh (1885), p. 45, pl. VIII, figs. 4, 5; pl. IV A, fig. 12; pl. V A, figs. 1, 2.
Moore (1903), p. 420.

A single individual was obtained by Professor Flynn off Maria Island at a depth of 1,300 fathoms.

This is an instance of the wide distribution of animals living at great depths for it has been recorded from the Antarctic to the coast of Japan.

It has been met with by the "Challenger" at the following places:—Between Prince Edward Island and Kerguelen, at a depth of 1,600 fathoms. Midway between Australia and the Antarctic, at 1,950 fathoms. Also in the North Pacific (lat. 35° 41′ N., long. 157° 42′ E.) at 2,300 fathoms, and (lat. 35° 22′ N., long. 169° 63′ E.) at a depth of 2,900 fathoms. While Moore records the variety from the coast of Japan at 3,774 fathoms.

Sub-family POLYNOINÆ.

Genus ENIPO *Malmgren.*

ENIPO RHOMBIGERA *Ehlers.*

Ehlers (1908), p. 47, pl. IV, figs. 1–12.
Ehlers (1912), p. 13.
Ehlers (1913), p. 449.
Gravier (1911), p. 81.

Of this very distinctly patterned species, which is confined to the Antarctic region, as many as forty-two specimens were gathered by the "Aurora" from eight stations and from one unnamed locality.

The plan of colouration is sufficiently described and illustrated by coloured figures by Ehlers, and some other variations of pattern are mentioned by Gravier. I have only to add that in one specimen, which measured 100 mm., the dorsum is very darkly coloured. The violet median band, with its rhomboidal outgrowths, is nearly continuous on the elytriferous segments; with a streak of dark brown along the hinder half of the segment; while in the cirriferous segments, where the median band is not produced outwards, there are two parallel cross-bars of brown, extending inwards from the cirrophore, one in front, the other behind it, nearly meeting the median pigmented band.

The greatest length of any of my specimens is 100 mm., though others have been previously described that exceed this.

The figure of the head given by Ehlers is not quite satisfactory, since the median tentaculophore is so drawn as to suggest that it bore the tentacle (which is missing, as it usually is) on its upper surface, which would be a very unusual position in the family. As a matter of fact, however, it is the fault of the artist, for I find that the tentacle is inserted at the anterior extremity of the tentaculophore as usual.

Localities.—

Commonwealth Bay, Station D, 45–50 fathoms (two).
Station E, 55–60 fathoms (four).
Station 1, 350–400 fathoms (nine).

Station 2, 318 fathoms (five).
Station 3, 157 fathoms (three).
Station 8, 120 fathoms (ten).
Station 10, 325 fathoms (two).
Station 12, 110 fathoms (four).

Distribution.—South Victoria Land, Bouvet Island, Kaiser Wilhelm II Land, (Ehlers), Graham's Land, Alexander Land (Gravier).

Genus HOLOLEPIDELLA *Willey*.

HOLOLEPIDELLA FLYNNI *sp. nov.*

(Plate 5, figs. 14–20).

The species is founded on four slender worms collected off Maria Island, Tasmania, by Professor T. T. Flynn. The pale grey dorsum is covered by white and nearly opaque elytra, which occur almost over the entire length of the body.

The largest individual is about 40 mm. in length and contains 63 segments. Its greatest breadth is in the region of segments 5–13, where it measures 4 mm. over the body; 5·5 mm. across the parapods; and 7·5 mm. including the chætæ. From this point the body begins to taper so that at the 26th segment the breadth is only 2·5 mm., while at the 40th it is but 2 mm. The length of the parapods does not sensibly decrease till quite close to the hinder end.

The total number of elytra is rather difficult to decide, as the majority have fallen away; but by counting the elytrophores I find that there are at least 26 pairs. In a small individual, which measures 27 mm., with 61 segments, 18 pairs of elytra are in position, the last being on segment 41, but there are elytrophores posterior to this.

I find, as did Willey, that it is by no means easy to distinguish elytrophores from cirrophores, from which the cirri have fallen away, both are nearly in the same line, close to the margin of the body; but by comparing the four specimens and especially after the examination of one that was stained and mounted, which lacks, however, the last 2–3 segments, one can fairly readily distinguish the two structures.

In this species the elytra are arranged as follows:—The first 12 are on the usual segments, that is (counting the peristomium as 1st) on the segments 2, 4, 5, 7–21, 23; the next six elytra appear to be regularly on every third segment—26, 29, 32, 35, 38, 41. It is hereafter that irregularity creeps in, but in all the four individuals I find elytra or elytrophores on the next segment, 42nd; in two instances they occur on the next two segments, that is, on three consecutive segments. Further back they are either on alternate segments or with gaps of two or three segments at intervals; or on consecutive segments. The arrangement is not symmetrical, so that no general statement covers their position; no formula can be given for these posterior elytra,

Willey (1905, p. 251) found a similar irregularity in *H. commensalis*. I place the facts in tabular form for reference :—

Number of Elytron in the series.	Posterior elytra of right side carried by the segments in each of the four specimens.			
	A.	B.	C.	D.
19	42	42	42	42
20	45	46	43	43
21	46	48	44	44
22	47	51	...	46
23	49	...	...	48
24	50	...	...	50
25	55	...	...	54
26	56	...	...	58
27	57	...	...	...

A is the stained and mounted specimen.

In B, only 22 pairs of elytra were present, the remainder of the 58 segments being cirriferous.

C is soft, and it is impossible to distinguish the elytrophores from the cirrophores.

The elytra, except the first which is circular, are oval with the longer axis oblique to that of the body ; and in the better preserved specimens they overlap from side to side. The " areola " is near the external margin, the surface is smooth, and there is no marginal fringe.

The prostomium (fig. 14) is colourless, broader than long ; the eyes are large, the posterior pair far back, latero-dorsal in position, with a large lens ; the anterior pair are lateral, with the lens directed forwards ; these are situated at the broadest part of the prostomium, which is rather in front of the the middle of its length. The prostomium is produced into distinct " peaks," immediately above the base of the lateral tentacles. The tentacles are smooth, tapering to a point ; the median is about twice the length of the laterals and longer than the palp. The laterals are about $\frac{2}{3}$ rds the length of the palp.

The parapods (fig. 15, 16) are short, and distinctly divided into two nearly equal lobes. The notopod, of less height than the neuropod, is like it produced into a long and slender aciculum-containing process. The dorsal cirrophore overhangs the chætigerous lobe ; the cirrus is smooth, tapering, very long and easily broken off.

The notopod contains only about 8–10 short yellow straight and stout chætæ with extremely fine transverse lines which appear to represent the " pectinated " frills of other genera, and these lines in older bristles are often worn away (fig. 20).

The ventral chætæ (fig. 17–19) are about twenty-four in number; each is, shaped like a spear head, the frilled region is short and marked by many very fine closely-set pectinated frills which take an undulating course across the bristle, and are visible along both edges. The chætæ are not all alike, some being more slender and having a longer frilled region than others. The frills commence at some distance from the tip, which is curved and carries a short sub-apical tooth.

I have placed this species in Willey's genus, which is defined as follows:—"A polynoid; antennæ arising at a lower level than the tentaculum impar, segments and elytra numerous." It does not fit into any other genus, though it is remarkable that the two species should occur in such widely separated localities, the type species living on the shores of Ceylon.

Locality.—

Off Maria Island, Tasmania, 1,300 fathoms.

Genus PHYSALIDONOTUS *Ehlers.*

PHYSALIDONOTUS RUGOSUS *Benham.*

Benham (1915), p. 182, pl. XXXVIII, figs. 16–22; pl. XXXIX, figs. 23–25.

Two individuals were obtained in the neighbourhood of the spot at which the type was taken.

Locality.—Off Maria Island, Tasmania, 65 fathoms.

Distribution.—Bass Strait, coast of Victoria.

Genus HARMOTHOE *Kinberg sensu-lato.*

HARMOTHOE SPINOSA *Kinberg.*

H. spinosa Kinberg (1855), p. 386.
H. spinosa Kinberg (1857), p. 21, pl. VI, fig. 31.
Polynoe fullo Grube (1877), p. 515.
P. vesiculosa Grube (1877), p. 514.
Lagisca antarctica McIntosh (1885), p. 80, pl. XIII, fig. 1; pl. XVI, fig. 3; pl. XVIII, fig. 1; pl. VIA, figs. 10-11.
L. magellanica McIntosh (1885), p. 82, and the varieties of this species.
H. spinosa Ehlers (1897), p. 12.
H. spinosa Willey (1902), p. 264, pl. XLI, figs. 1–4; pl. XLIII, figs. 1, 2, 4-8.
H. spinosa Ehlers (1908), p. 43.
H. spinosa Ehlers (1912), p. 10, pl. I, fig. 8.
H. spinosa Ehlers (1913), p. 438, pl. XXVI, figs. 1-12.
H. spinosa Gravier (1906), p. 33.
H. spinosa Gravier (1911), p. 88, pl. V, figs. 54-59; pl. VI, figs. 64-69.
H. spinosa Fauvel (1916), p. 421, pl. VIII, figs. 8-9 (chætæ).
H. spinosa Fauvel (1917), p. 179, pl. VI, figs. 47-48 (head).

(Plate fig. 21.)

Ehlers gives some coloured pictures of this common Antarctic Polynoid, in his account of the National Antarctic Expedition, and of its varieties, in the report of the German South Polar Expedition, above referred to.

In the "Challenger" report, McIntosh figures the head and the chætæ of the species and varieties as distinguished by him; and Willey represents the general appearance of the animal and the characteristic tubercles on the elytra.

For a full list of the synonmy and literature consult Ehlers (1913).

The species is evidently extremely abundant in Commonwealth Bay, as 169 individuals are included in the collection, obtained from depths varying from 2 to 400 fathoms, and it probably lives along the shore also, as Ehlers has noted its abundance along shore at all seasons of the year at Kaiser Wilhelm II. Land.

It is, as is well known, extraordinarily variable in colouration, and Ehlers has figured several of the more usual types.

I find large as well as small individuals in which the elytra are colourless, so that the worm has a greyish appearance, though the more typical colour is some tone of brown, usually a chestnut, with or without a purplish tinge.

In some the elytra are uniformly tinted; in others the pigment is in definite patches, which are either small and scattered irregularly over the surface, or arranged in definite lines parallel to the long axis of the worm; in still others the patches are so closely crowded together that they produce a nearly uniform darker tone.

In most cases the "areola," that is the area above the attachment of the elytron to its elytropore, is without pigment. In some individuals a reddish-purple spot or even a violet spot lies behind this areola; or, again, this is reinforced by an additional purple splash near the posterior external border; this spot may occur both in pale and in darkly pigmented elytra.

The upper surface of the elytra is often iridescent, and so adds to the beauty of the worm, giving as it does a bluish tinge to the brown in certain parts of the elytron, according to the angle at which light is reflected from it.

Further, the body wall is pigmented in various ways, and in various tints independently of the colour of the elytra. In some specimens the dorsum is almost without pigment, but it is usually crossed by narrow bars of brown or olive, which are confined to the median region of the back. Very frequently there is a tesselated, or chess-board pattern of brown or of olive-green, or of both colours combined, giving a beautiful effect (fig. 21). In such cases the pigment is in the form of quadrate patches on each side of the middle line on alternate segments, the median line being white; and in the intervening segments, the sides are pale and transverse bars of pigment cross the middle line.

But the most remarkable variant is found in the largest individuals, where the entire dorsum is a uniform steel-blue or indigo-blue, or purple (as in Ehlers's fig. 1, 1913), with the bases of the parapods white or pale pink, or of a rather deeper lilac colour.

In one case the belly is nearly as deeply pigmented blue as the dorsum; but this is very exceptional, as the ventral surface is generally without pigment.

There seems to be no very definite correlation between the colouration and the depth at which the worms were found, for in sorting out the specimens from the jars in which they reached me, I rather naturally separated out those in which the colours were strikingly different, under the impression that I had to deal with distinct species. Thus, in one lot from 25 fathoms, I find four different plans of colouration or, as I supposed, four different species.

Nevertheless, after tabulating the worms under their colours and their depths, it seems that there is a rough correlation between them. Thus, in shallow water, from the shore line down to 60 fathoms, the general tone of colour of the elytra is darker and variegated in brown, while the dorsum is without pigment, or has pale transverse lines of brown. The elytra, too, are more firmly attached to the elytrophores than in other cases.

But in those worms that come from greater depths, say, 110–400 fathoms, the elytra are paler and more uniformly coloured, and may even be colourless and translucent; and they are readily deciduous. On the other hand, the dorsum is now pigmented more deeply or more extensively, and it is from these depths that the handsome dark blue and violet worms were obtained. But this applies only to the larger specimens.

The smaller worms are apparently less affected by depth ; or it may be that the change in the amount of pigment is a measure of age, for in a general way the smaller individuals are deeply coloured, while the larger ones, above 60 mm. in length, have pale or colourless elytra, with a more deeply pigmented dorsum. The smaller worms, from 10–30 mm. are generally found in less deep water than those from 40–90 mm.

The texture and ornamentation also of the elytra present considerable range of variation, for in some the surface appears under a lens to be smooth, whereas in the more typical forms there is a row of pale conical tubercles along the posterior border, as shown in Willey's figure 2, pl. XLI. These are usually better developed on the elytra from the hinder region of the body, while the more anterior ones may be without them. Again the entire surface may be covered with small cones, visible under a lens, and giving them a rough appearance to the naked eye. The marginal fringe may be present or absent.

The prostomium is usually white, whether the dorsum of the body is pigmented or not, but in one case at least, it is marked transversely by a narrow band of brownish pigment (as in var. *lagiscoides*, as figured by Gravier (1911), pl. VI, fig. 64). The peristomial cirri, anal cirri, and dorsal cirri are brownish.

In spite of these variations in colour there are two features in the distribution of pigment that appear to be constant, namely :—(1) the dark greyish-blue tint on the

upper lip of the mouth, and especially along its median line, on the ridge which extends upwards to the anterior margin of the prostomium; and (2) the elongated lips of the notopodial and neuropodial lobes are coloured dark brown or purplish brown.

These two features I found very useful in distinguishing readily the species from *H. tuberosa.*

As to the chætæ. The latest drawings are those of Fauvel (1916, pl. VIII, figs. 8, 9). He shows the dorsal chæta as having a row of stout spines along one edge, each spine being apparently the enlarged marginal tooth of one of the pectinated frills. My own observations do not bear out this interpretation; the frills certainly project a good deal beyond the edge, and the appearance produced is of rather stout spines, but I interpret this as being due merely to the fact that two or more of the pectinations are here seen one over the other, producing indistinct thickening of the frill. I do not find definite spines here, nor do other authors.

In the ventral chætæ, however, there are in the distal frills definite spines which are shown by Willey (pl. XLIII, fig. 2).

In this paper (1902) Willey distinguishes "three principal allotypic modifications" of the species, one of which he retains as a distinct species, and refers it to McIntosh's *Lagisca crossetensis.* The other two are described as varieties of *H. spinosa,* namely, "var. *typica*" and "var. *fullo,*" with a sub-variety "*lagiscoides.*" The two latter varieties are characterised by, among other things, the presence of long conical tubercles or spines on the elytra; the last variety by the fact that the hindmost segments are not cervered by the elytra.

Gravier (1911) describes in detail examples of the two varieties, "*typica*" and "*lagiscoides,*" and mentions that the latter has the elytra more deeply pigmented than the former.

I have, as already noted, a very large series of the species—but I have failed to find any in which the hinder segments are thus exposed. It is true that I have not been able to give the time to sorting out of this series into groups or varieties, and the range of variation in several characters is very considerable, as Ehlers has shown, yet both in large and small specimens, in those with dull and in those with bright colouration the elytra cover the whole body. It must, however, be noted that in many cases the elytra had fallen away; but I find, as Gravier did, that none of those examined with this purpose possess as many as forty segments, the number given by Willey for this particular individual. Is it possible that he had under observation some other species ?

Localities.—

Boat Harbour—

2–4 fathoms, coll. by Dr. A. L. McLean (fourteen).

$3\frac{1}{2}$ fathoms, coll. by Dr. A. L. McLean (twenty-one).

$4\frac{1}{2}$ fathoms, coll. by Dr. A. L. McLean (three).

Commonwealth Bay—

Station B, 25 fathoms (sixty-five).

Station C, 15–20 fathoms (fourteen).

Station D, 45–50 fathoms (twelve).

Station E, 55–60 fathoms (eleven).

Station 1, 340–400 fathoms (nine).

Station 3, 157 fathoms (one).

Station 8, 120 fathoms (five).

Station 10, 325 fathoms (two).

Station 12, 110 fathoms (twelve).

Distribution.—Magellan Strait (Kinberg, Grube, McIntosh), Marion Island, Prince Edward Island (McIntosh), Cape Adare (Willey), Coulman Island, Kaiser Wilhelm II Land (Ehlers), Graham's Land (Gravier), Falkland Islands, St. Vincent Gulf and Spencer Gulf, South Australia (Fauvel).*

One of the specimens from Station C has a parasitic Copepod attached between two of the parpaodia, as figured by Willey (pl. XLI, fig. 4).

HARMOTHOE TUBEROSA *Ehlers.*

Harmothoe spinosa, variety Ehlers (1908), p. 43.

Harmothoe tuberosa Ehlers (1912), p. 11, pl. I, figs. 1–7.

(Plate 6, figs. 22–29.)

The account given by Ehlers, apart from one or two details, is adequate. The coloured figure represents a much redder tint than is exhibited by any in the present collection, where the worms are grayer, sometimes paler, sometimes darker, sometimes with a purplish tone, sometimes bluish, and usually with a metallic lustre.

It does not appear to attain the dimensions of *H. spinosa*, for the largest individual measures only 50 mm., with a diameter over the elytra of 15 mm. The body itself, measured on the ventral surface at segments 7–18, is 7 mm. across: thence it tapers gradually, so that at the 26th segment its breadth is 5 mm.

The species is apparently much rarer than *H. spinosa*, for though it occurred in eight hauls, which yielded twenty-six individuals, and except at a depth of 25 fathoms (Station B), only one or two were obtained in a haul. It is apparently commoner at the less depths, for at this Station B as many as fifteen specimens were brought up by the dredge.

* Fauvel mentions a specimen as occurring as a commensal in a tube of *Thelepus* sp.

It occurs in each case in company with *H. spinosa*, but in much less numbers. For example, whereas at 15–20 fathoms fourteen specimens of *H. spinosa* were obtained, there was only one of *H. tuberosa* ; at 25 fathoms, in contrast with sixty-five specimens of the former, there were only fifteen of the latter. Although Ehlers originally regarded it as a variety of *H. spinosa,* since it seems nearly always to occur in association with it, yet in his later work he pointed out that it is a very distinct species.

There are one or two features which readily serve to distinguish it at sight from *H. spinosa* : (1) The dorsal chætæ, instead of projecting outwards, have a radiating arrangement, as is shown by Ehlers's figure ; (2) The absence of pigmentation of the upper lip and of the ends of the parapodial lobes (" acicular processes ") which is practically universal in *H. spinosa.*

The dorsal surface of the body is free from pigment, so far as my observations go, but the lateral longitudinal ridges along the ventral surface are crossed by bars of brown, and the posterior feet may be pigmented on their lower faces. The ventral surface thus appears dark.

Ehlers has directed attention to the peculiar transverse " pads " which occupy the median line of the dorsal surface in each segment, and the " cushions " on the cirriferous segments in line with the elytrophores, the cirrophores being situated far out on the bases of the parapodia. Both these structures occur also in the genus *Physalidonotus*, which Ehlers founded for a Branchiate Polynoid from New Zealand, in which the head, however, is " lepidonotan." Having had several species of this genus under examination recently, it occurred to me that possibly there might be gills here also, but on investigation I find that they are absent.

The dorsal chætæ are " bearded " in the same sort of way as are those of *Physalidonotus*. It is evident that Ehlers had before him and has figured a much-worn chæta, and that he failed to recognise the true nature of this " bearding," for he writes, " ich mag nicht entscheiden, ob diese Faden durch Aufsplitterung des Borstenendes entstanden oder epiphytische Bildungen sind."

To me neither of these explanations of the appearance presented by the chætæ is the correct one. These long " Faden " are similar to those originally figured by Moore (1903) for certain species, which he named *Lepidonotus branchiferus* and *L. chitoniformis* (pp. 405, 409, pl. XXIII, figs. 7 and 10), which really belong to the genus *Physalidonotus*. More recently I have figured the chætæ for *P. rugosus* and *P. paucibranchiatus* (Benham 1915, pl. XXIX).

A more detailed account of the dorsal chætæ of *H. tuberosa* is, therefore, desirable. In a perfect unworn chæta the tip is smooth and rather bluntly pointed. Below this smooth region there come three or four pectinated frills* which are produced into long

* This term was used by A. G. Bourne in his account of the chætæ of *Lep. clava.* (Trans. Linn. Soc. London., vol. ii, 1883.)

delicate hairs, extending beyond the tip, surrounding it and more or less concealing it. Similar but less developed frills follow and occur along the greater part of the chætæ (fig. 22).

When studied under a higher power the chæta appears to be triangular or possibly quadrangular in section (figs. 23, 24). Along two edges are ranged two series of spines or teeth, which decrease in size as they are traced downwards proximally. Each pair of teeth is connected across the "front" of the chæta by a finely-striated membrane or pectinated frill, the margin of which is comblike, as if it were made up of many very delicate chitinous hairs closely set side by side. In the more distal of these combs the hairs gradually increase in length, and become flexible until the long hairs that form the "beard" are produced. Similar but less developed frills extend outwards beyond the teeth, down the "sides" of the chætæ, but in the proximal portion this lateral frill is replaced by a series of minute conical teeth (fig. 24). The spines or teeth are evidently merely specialisations of the comb-teeth.

The shorter upper chætæ of the bundle have simple frills, but as the chætæ get longer the four or five of the distal frills become produced into the long hairs. There is quite a gradual transition between the chætæ with simple frills and those with well-developed "beards."

These "beards," as Ehlers notes, entangle mud and debris, so that it is not always possible to obtain a good view of the apex and to make out the real structure, but in some of my mounts, both in Canada balsam and glycerine jelly, the apices are fortunately free of mud and the structure is quite apparent.

The ventral chætæ, too, are worthy of closer description than Ehlers has given them. They are quite different from those of *H. spinosa*, as he has shown.

Each presents two parallel series of short stout teeth or spines along the concave edge, four or five in a series in the case of the longer chætæ, but reduced to three in the smaller ones (figs. 25–27). The more distal spines in each series are simple and tooth-like, but lower down each is seen to be surrounded at its base by a pectinated frill, or, lower still, to be replaced by a frill whose edge, under a low power, has the appearance of a tooth (fig. 27). These upper frills have quite a limited extent, but below them come four to six closely-set small frills of very short pectinations which run right across the chæta from side to side.

The elytra on two of the individuals studied present marked variation from the typical structure. In addition to the characteristic sub-marginal papillæ, the elytra bear conical and vesicular tubercles of brown colour. On the anterior elytra they are comparatively small, lying on the uncovered posterior region of the scale, but on the more posteriorly situated elytra the tubercles become more conspicuous. They are here larger, though less numerous, till, on the last six or seven, they are truly enormous vesicles (fig. 28). Whereas the tenth elytron carries some half dozen of these vesicles, the fourteenth bears but one (fig. 29). These vesicles appear to be much enlarged and dilated tubercles derived from the ordinary echinulate tubercles characteristic of the species.

Just as there is a variety of *H. spinosa* (*Lagisca antarctica* or *L. vesiculosa*), so here we have a variety of *H. tuberosa,* differentiated by the great size of the tubercles; but here they are conical, rather than spherical, and recall those figured by Kinberg for *H. patagonica* (1857, pl. V, fig. 22 H).

Localities.—

Boat Harbour, winter quarters, Station A, 3½ fathoms (one individual).
Station B, 25 fathoms (fifteen).
Station C, Commonwealth Bay, 15–20 fathoms (one).
Station D, 45–50 fathoms (one).
Station E, 55–60 fathoms (two).
Station 1, 350–400 fathoms (one).
Station 3, 157 fathoms (one).
Station 8, 120 fathoms (two).

Distribution.—S. Victoria Land; Bouvet Island (Ehlers).

HARMOTHOE ABYSSORUM *McIntosh.*

Eunoa abyssorum McIntosh (1885), p. 73, pl. XI A, figs. 14–16.

(Plate 6, figs. 30–35.)

Three specimens of this species were obtained, and as the type was dried up, so that McIntosh was unable to say much about its anatomy, an opportunity occurs of adding to that brief account.

The largest of them is 29 mm. long, with 35 segments, but is imperfect. It is broadest at about segments 7–12, thence tapering. Here it measures 5 mm. across the body, 10 mm. over the parapods, and 12.5 mm., including the chætæ. At segment 20 these numbers are 3 mm., 6 mm., and 9 mm. respectively, so it is clear that only a few segments are missing.

The ventral surface of the body is purplish, darker posteriorly, and the pigment extends on to the feet, where, however, it becomes fainter. The dorsum is devoid of pigment.

There are fifteen pairs of elytra, which are present on one of the smaller individuals. They are colourless, translucent, and rather thick, but towards the external margin they become slightly yellowish and opaque. They are smooth not only to the naked eye, but even microscopically, except that over the outer area there are numerous minute, rounded refringent tubercles, which seem to be the cause of the yellowness here (fig. 33).

The prostomium (fig. 30) is broad, with well-developed peaks on the outer side of the bases of the lateral tentacles; both pairs of eyes are on the dorsal surface, and lie behind the middle of its length. The two eyes of one side are thus close together,

being separated from one another by about the diameter of an eye. They are large, and herein there seems to be a difference from the type, of which McIntosh says that it " appears devoid of eyes."

The median tentacle is absent from both specimens. The laterals spring from below it (fig. 31), and are directed parallel with it, not divergently as in some species. They are tapering without any subterminal swelling; they bear a few microscopic hairs. In length they are short, being not quite twice the length of the prostomium. The palps are long, smooth, and of a greyish-brown colour.

The parapods are bilobed (fig. 32). The notopod has a long acicular process which is more slender than that of the neuropod. The anterior feet are longer than the posterior. The chætæ are pale yellow or, as McIntosh terms them, " straw-coloured." The dorsal chætæ are more numerous than the ventral, being 15–20 in number. They form an upwardly directed tuft of shorter, stout and straight bristles, and a few in the lower part of the bundle are longer and directed outwards. The pectinated frills (fig. 34) nearly surround the axis. At any rate, they extend across it over the greater part of this region; the distal portion of the bristle is smooth and rather sharply pointed.

The ventral chætæ are few in number, from 5–8, usually 6. They appear to be in a single vertical series, decreasing in length from above downwards. They are rather stouter than the largest of lower ones in the notopod, but they are a good deal longer.

The frilled region (fig. 35) is rather short, and is somewhat enlarged. The frills are few, some 12–14, and delicate; the distal frills are not continuous, but each is represented by two or three isolated groups of pectinations, and lower down these extend till they meet and form a continuous frill of fine short, hair-like processes, which takes an irregular course across the bristle and reaches the convex border or " back." The smooth apex is curved, and there is no sign of a sub-apical tooth.

The form of the chætæ agrees with the figures given by McIntosh, though I have added some little details.

Localities.—

Station 10, 325 fathoms (two).

Station 11, 358 fathoms (one).

Distribution.—South of Australia, Lat. 42° 43′ South, Long. 134° 10′ East, 1,600 fathoms.

Genus EULAGISCA *McIntosh.*

EULAGISCA CORRIENTIS *McIntosh.*

McIntosh (1885), p. 91, pl. XIII, fig. 4; pl. VII A, figs. 3, 4.

(Plates 6 and 7, figs. 36–42.)

The larger of the two specimens of this rare worm is 83 mm. in length, with a diameter of 11 mm. over the body, and 23 mm. over the parapods. It contains 37 segments. The smaller consists of 33 segments, is only 20 mm. by 3 mm. over the body and 8 mm. including the parapods, which are relatively long.

Judging from McIntosh's remarks, a structure that seems characteristic is a sub-tentacular frontal cone, which he refers to as a "sub-tentacular cirrus" though this term does not seem altogether applicable to such a short conical process. This "frontal cone" is situated between the bases of the palps immediately below the median tentacle (fig. 37). It is quite distinct and separate from the ridge which forms part of the upper lip, and appears to spring from the underside of the prostomium itself. When the median tentacle is absent, as it is in one of the two individuals, this frontal cone is seen projecting beyond the tentaculophore (fig. 36). It is white with a brown base. McIntosh refers to this "remarkable" organ as being "unique" (p. 93), and in this place does not refer to any other species except some of the Acoetinæ as presenting anything like it. Nevertheless on p. 112, in the course of his account of *Polynoë platy-cirrus* he does mention that a small cylindrical boss occurs in the same position. I have examined a specimen of this species and can confirm this statement, but it has a spherical shape and is by no means so noticeable as in Eulagisca. The use of the word "unique" seems to suggest that it is one of the generic characters of Eulagisca, especially as he gives no diagnosis of this or any of the new genera and sub-genera he had occasion to establish. I do not recall meeting with any reference to such a structure in more recent works dealing with the Polynoids; yet it is a structure that is so definite that it may have a wider range and be of value in differentiating some of the species of that puzzling group.

The ventral surface of the worm is colourless, the chætæ are pale brown. The dorsum is marked with very-pale chestnut brown in the median anterior region, and darker on the peristomium. At about $\frac{1}{3}$rd of the body length, this continuous band of pigment breaks up into a series of irregular patches which get fainter and smaller till about the last quarter, when they die out.

The prostomium is colourless, though in one specimen it has a crescentic mark of dark brown across each half, which is lacking in the other specimen. There is a small patch of dark-brown on the upper surface of each of the cirriferous segments just within the cirrophore, and in the elytriferous segments a corresponding patch. The dorsal cirri have a ring of very pale brown below the subterminal swelling. The anus is surrounded by a dark-brown area.

The prostomium is broader than long, has no peaks, and the three tentacles arise in one plane; the anterior region of each half is continued into the tentaculophore, though in the smaller individual, which is less well-preserved than the larger, each half of the prostomium appears to be produced into an internally directed peak; but this is due to the oblique line separating it from the lateral tentaculophore.

The eyes are relatively large, and each is provided with a lens; the anterior are situated laterally about half-way along the prostomial lobe at its broadest part; the posterior eyes are dorsal, about half-way between the anterior eye and the hinder margin, though they appear further back in the less well-preserved individual. The hinder margin of the prostomium is over-hung by a forward continuation of the peris-tomium.

In the smaller individual all the prostomial appendages are present, but they are absent in the larger. The median tentacle is about twice the length of the laterals; they are colourless, even translucent, with an opaque white sub-terminal swelling. The tentaculophores are dark-brown, as also are the peristomial cirrophores. The palps are very long, twice the length of the median tentacle; while the peristomial cirri are as long as, or even longer than, the median tentacle.

Although these appendages appear smooth to the naked eye, they are in reality ciliate. McIntosh states that the cilia are numerous in his specimens, but I find them comparatively few and far apart.

The parapods (fig. 39) are not very prominent, the notopod smaller than the neuropod, and each has a long narrow acicular process, that of the neuropod reaching further outwards, but actually the two are of equal length.

The aciculum is colourless, very delicate, and produced into a fine point which projects beyond the tip of the process in which it lies. The dorsal chætæ (fig. 40) are 8–10 in number, stouter than the ventrals, the upper ones curved, the lower straight. The apex is short and sharply pointed, being slightly concave on one side. The whole chæta is crossed by pectinated frills which only extend for about half-way across the axis.

The ventral chætæ (figs. 41–42) are long, very fine, and somewhat flexible; they have a very long frilled region consisting of about 30–40 frills, and a comparatively long delicate and simple apex. The upper ventrals are nearly straight; the apex long and very fine; the rest have a curved apex rather hooked, but there is no sign of a sub-terminal tooth.

I note an opacity near the apex of the dorsal chætæ to which McIntosh refers. The ventrals differ from his figure in the much greater length of the point.

The elytra are 15 pairs, though most of them are lacking in the specimens. The two anterior elytra on each side are thin and splashed with dark sienna brown; the first one is sub-circular, the second oval (fig. 38). This has a nearly central "areola" with a patch of brown pigment on its outer edge; there are three large, broad, round-tipped conical tubercles near the external margin, and springing from the surface of the scale between them, but nearer to the margin, are a few long, fine, cylindrical hair-like papillæ. The concealed portion of the elytron bears numerous small, rounded, low, and highly refringent tubercles, only visible under a high magnification. There is no fringe.

Locality.—

Station 8, 120 fathoms (one).
No data (the larger of the two).

Distribution.—Between Kerguelen and Heard Islands; also Buenos Ayres (McIntosh).

Remarks.—The " Challenger " obtained only two specimens, one complete and one incomplete and it has not been recorded since. The name *Eulagisca* seems to me to be unfortunate, as the head is so entirely different from that characteristic for the genus *Lagisca.* McIntosh writes : " The bristles are allied to those of *Lagisca,* while the eyes, scales, ventral papillæ diverge. The subtentacular cirrus is unique and is akin to the proboscidian process of Acœtidæ."

Genus HERMADION *Kinberg.*

HERMADION ROUCHI *Gravier.*

Gravier (1911), p. 82, pl. III, figs. 33, 34 ; pl. IV, figs. 45–51; pl. VII, fig. 74.

Harmothoe crosetensis Ehlers (1913), p. 442, pl. XXVII, figs. 1–4 (nec *Lagisca crosetensis* McIntosh).*

(Plate 7, figs. 43–47.)

Of the ten specimens which I attribute to the species, two, measuring 18 mm. with 27 segments, and 22 mm. with 38, are closely similar to Ehlers coloured figure (fig. 1) of the worm to which he applies the name " *Harmothoe crosetensis* McI." That is, the elytra are alternately darker and very pale—in the case of his specimens, gray in colour, in mine, olive-green or olive-brown in the two individuals respectively. The dorsal chætæ are golden, long, and overarch the dorsum and even inter-digitate with those of the other side. In these and practically all other details of structure my specimens agree with the account given by Ehlers. But these features—especially the great length and the position of the dorsal chætæ—do not agree with the description and figures of *Lagisca crosetensis* given by McIntosh, whose figure of the entire worm shows, on the contrary, quite short chætæ, not overarching the dorsum in the slightest degree.

Moreover, Ehlers states that the ventral chætæ are not bidentate which is a characteristically developed feature of *L. crosetensis* ; indeed the only feature in which the worm agrees with that of McIntosh is that the elytra bear sharply-conical tubercles.

At first I was content to accept the identification by the most experienced European student of exotic Annelids, till I came to examine another lot of worms of larger size than the two above mentioned ; these are without pigment and agree in all essential features with Gravier's account of *Hermadion rouchi.*

I then returned to these smaller specimens of what I had thought were *Harmothoe crosetensis*, and after a careful comparison of organ with organ of the two lots, I found that they presented such a close agreement as to amount to identity, so that I came to the conclusion that the smaller coloured individuals are the young of *Hermadion rouchi.*

* Whether the species briefly described by Willey (1902, p. 266) belongs to McIntosh's species or to Gravier's I am unable to decide, but the sketch (pl. xliii, fig. 3) of the tip of the ventral chæta inclines me to think that he had *H. rouchi* before him, as it differs from the figure given by McIntosh for his species and seems to have stout spines on the first frill ; but the figure is rather indistinct in this respect.

In order to establish the above conclusion, I will give the measurements of the worms.

A.—The small worms, with coloured elytra.—

(1) Nearly complete, with green elytra ; 18 mm. in length, with 28 segments; width at the 7–12th segment is 4 mm. over the body, measured ventrallly; 6 mm. over the neuropod, and 9 mm. over the chætæ. The dorsum is marked with dark-green narrow transverse bars at the sides and with a thin green line on each segment, crossing from side to side. No information as to the locality.

(2) Is similarly coloured, though with brown ; the posterior end, after the 28th segment, is regenerated, with 9–10 minute segments. The length is 22 mm. for these 38 segments. This individual is rather soft ; the dorsal chætæ do not meet their fellows, though they overarch the back. (Station 12.)

B.—Uncoloured individuals, *i.e.*, the elytra are without pigment.—

(3) Length, 23·5 mm. with 39 segments ; width 7 mm. over neuropods. (From Station 10.)

(4) About the same size, though imperfect. Quite similar to number 3. No data as to locality.

The remainder were taken together at Station 1.—

(5) 28 mm. with 41 segments with 7 segments exposed behind the elytra.

(6) 32 mm. for 42 segments.

(7) 40 mm. with 44 segments.

(8) 51 mm. with 45 segments, last 10 segments uncovered.

(9) Imperfect, but intermediate in size.

(10) The largest is 81 mm. with 46 segments, of which the last 13 are uncovered.

We have here a gradual increase in length with segments added at the hinder end ; and there seems no doubt that, since all agree in their structural details, we are dealing with a single species at different ages. Variation in colour now is so well known, as for instance in *H. spinosa,* that little reliance can be given or placed on that as a specific character.

I may add that the largest of the three specimens contained in the French collection measured only 42 mm. with 42 segments, while the two smaller ones were about 24 mm. in length. Gravier states that in his specimens the dorsum is unpigmented, but in each segment there are two narrow cross-bars of dark violet ; he also notes that pigmentation is less marked in the larger than in the two others.

It will be well to give in some detail some facts about the specimens from Commonwealth Bay.

The largest individual is 81 mm. long ; the width of the body measured ventrally in the region of segments 12–18, is 12 mm. ; it is 19 mm. over the neuropods ; and 28 mm. including the ventral chætæ. The number of segments is 46. The elytra are uncoloured ; the dorsal body wall is without pigment, being flesh-coloured, except for a band of pale violet on the tentacles and cirri below the subterminal swelling, and a small violet or brownish patch on the anterior face of the dorsal cirrophores.

In the smaller coloured specimens, the tips of the acicular processes are also violet.

The species has, as Gravier remarks, a quite characteristic appearance, owing to the very long, straight dorsal chætæ of beautiful golden colour which radiate in all directions from the upper surface of the large notopods, some of which overarch the elytra.

The anterior elytra, as well as those at the posterior end of the series, overlap right and left, but in the middle region of the body, they leave the dorsum exposed, while some dozen segments lie behind the last elytra.

The account given by Gravier fits the present specimens so completely that it is only necessary to note one point in which they appear to differ from those described by him.

Of the dorsal chætæ, Gravier states that the majority exhibit no ornamentation, though some of the lower ones of a bundle are traversed by a few cross-markings, and present indications of marginal denticulations (see his pl. IV, fig. 48).

Ehlers, in his figure (pl. XXVII, fig. 4) shows a series of pectinated frills crossing the chætæ from side to side. I agree with him, though his figure shows them rather too widely separated from one another and is so drawn as to imply that they have a spiral course.

I find that in the younger individuals there is a fairly long smooth apex with a blunt point (figs. 43, 44, 45), which in some of the older specimens, especially in the chætæ in the uppermost part of the bundle, is frequently worn away, so that there is no smooth region and the tip is almost truncated. Below this smooth region there follows a series of about 30 closely set transverse pectinated frills which nearly encircle the chæta ; each consists of minute teeth, and the frilled region occupies about half the length of the exposed portion of the chæta, or even more in the shorter bristles of the lower part of the bundle.

While speaking of these dorsal chætæ, I may refer to a point on which I must differ from Ehlers. In those smaller individuals which so closely resemble the specimens described by him as *H. crosetensis* in all other respects, I find none of the long slender hair-like bristles which he describes and figures as occurring in some of his specimens. On p. 443, he describes the notopod as bearing in addition to and intermingling with the stout yellow chætæ " sehr langen und haar-feinen Borsten," which project over the

dorsum and may even interdigitate with those of the opposite side (pl. XXVII, fig. 3). He says further (p. 444) that although they are not present in all individuals, he has found them in both small and large specimens, and he suggests that their presence may bear some relation to sexual maturity. I have examined several parapods taken from both large and small specimens with the especial object of finding these fine capillary bristles. Occasionally some of the chætæ may be seen edgewise and so appear thinner than when seen on the flat surface, and frills are then seen to project from both edges giving an appearance somewhat like Ehlers's figure. But I do not find such difference in length as he found. Gravier does not mention their occurrence in his specimens, and on the presumption that we are dealing with the same species, this is the only feature in which ours really differ from those examined by Ehlers. I may add that McIntosh does not mention such bristles in his account of *L. crosetensis*.

So far, then, as the present specimens are concerned, all the dorsal chætæ are alike in structure, though they differ in length ; those in the lower part of the bundle being about half the length of those in the upper part.

The same difference in size exists amongst the ventral chætæ. The ventral chætæ (figs. 46, 47) which in *L. crosetensis*, McIntosh states are " not furnished with long spines, and have a distinct sub-apical tooth;" have in the present case, as Gravier has figured (pl. IV, fig. 49) certain pronounced spines or teeth amongst the upper frills, which are absent in the lower frills. In some chætæ two such spines occur on one side and one on the other; in other cases, two on each side. The frilled region is long, consisting of about 20 frills which are discontinuous in the distal region, but become continuous over the greater part. Ehlers says little about the ventral chætæ, except to state that the apex is simple. Why then should he refer it to the species *L. crosetensis*?

However, in *Hermadion rouchi*, although most of the ventrals have a simple apex, with no sign of a sub-apical tooth, there is occasionally a sub-apical " step," which seems to indicate a tooth that has been worn away. And Gravier states that in some of his specimens he found a tooth.

More than one zoologist has in recent years commented upon the difficulty of distinguishing between the two genera, *Lagisca* Malmgren and *Hermadion* Kinberg, as well as upon the question of the distinction between them and the genus *Harmothoe* Kinberg. Most writers accept the last genus in an extended sense as including several of Malmgren's sub-genera, though Professor McIntosh still retains most of the latter; and in his splendid monograph of the British Annelids, published by the Ray Society, these names are even used as generic.

I need not discuss this matter further as Baron de St. Joseph (1888, p. 150) has given the history of these names. It was Willey (1902), I believe, who first drew attention to the resemblance between *Lagisca* and *Hermadion*. And Fauvel (1916) has recently summarised the main points in the controversy raised by him and also discussed by Gravier (1911). Fauvel concludes (p. 426) that *Hermadion* is distinguish-

able from *Lagisca* by the absence of the prostomial frontal lobes or " peaks ;" the dorsal chætæ are generally smooth or very feebly striated ; the ventrals unidentate in even in the young. Therefore, he believes that to unite the two genera would be premature.

But is the statement of differences altogether correct ? For Ehlers describes the presence of these " peaks " to two species, *Hermadion ambiguum* and *H. molluscum* (1897, p. 16); they are present in *H. rouchi*. It is true that these peaks are absent in the type species, *H. magalhaensis* Kinberg, as well as in his *H. longicirratum* and in *H. kerguelensis* McIntosh (1885), which according to Fauvel are synonymous. On the other hand, although typically present in *Lagisca*, they may be absent (see *L. jeffreysii* McIntosh, for instance). It seems as if there ought to be a great deal of shifting of these species from one genus to the other, if we accept Fauvel's dictum.

As to the dorsal chætæ, it appears that in young stages of *H. rouchi*, at any rate, as well as in other species, the dorsal chætæ do have striations, that is fine pectinated frills or combs, whereas in the older chætæ, the longer ones, they are less distinctly marked. It may be that this is due to wearing away of the frills owing to use. And a similar explanation may perhaps be given of the absence of a sub-apical tooth in the ventral chætæ. For although this is generally absent, yet it does occur in the shorter younger chætæ, or in others its place is taken by a " step," in this position.

It appears then that the distinctions between the two genera *Lagisca* and *Hermadion* do not exist. They are identical.

A further question has been raised as to whether or not there is any real distinction between the genera *Hermadion* and *Harmothoe*. If we review the various oligomeric forms, it appears that *Harmothoe* has its dorsum entirely covered by the elytra ; that none of the posterior segments remain uncovered, or at most only two or three. Whereas in *Hermadion*, several, up to a dozen or more, are exposed in large forms. It is true that Willey has ascribed to *Harmothoe spinosa* an individual which he regards as a variety and calls "*lagiscoides*," partly because of the conical tubercles on the elytra, and this one individual has 6 naked segments at the hinder end. But more information is needed to convince me that the individual is a variety of *Harmothoe spinosa*.

Yet, because of this variety, Willey proposed an addition to the generic diagnosis of *Harmothoe*, which would eliminate the only remaining constant difference between it and *Hermadion*, and so comes to the conclusion that all three genera are synonymous.

For the present, I am of opinion that it would be well to retain the distinction between *Harmothoe* and *Hermadion*.

Localities.—

Commonwealth Bay, Station 1, 350–400 fathoms (six, colourless).
Station 10, 325 fathoms (one juvenile, colourless).
Station 12, 110 fathoms (one juvenile, coloured).
No data (one coloured and one uncoloured, juvenile).

Distribution.—Marguerite Bay, île Adelaide (Gravier), Kaiser Wilhelm II Land (Ehlers).

Family PHYLLODOCIDÆ.

Sub-family PHYLLODOCINÆ.

Genus PHYLLODOCE *Savigny*.

PHYLLODOCE MADEIRENSIS *Langerhans*.

Langerhans (1880), p. 307, pl. XVII, fig. 44.
Willey (1902), p. 270, pl. XLII, fig. 5; pl. XLIV, fig. 7.
Ehlers (1897), p. 25.
Ehlers (1901), p. 72.
Ehlers (1913), p. 453.

Four individuals of this widely distributed species were obtained in dredgings in 25-120 fathoms. These are larger than the type, which only reached a length of 70 mm., with 105 segments, and than those described from the Antarctic by Willey. The present specimens attain a length of 190 mm., with nearly 300 segments. The greatest width of the body is 2·5 mm. to 3 mm., and over the parapods 6 mm., and does not vary much throughout the length.

The colour, which Langerhans found to be green in life, is in the preserved worms in some cases pale brown, with the dorsal cirri rather darker; in other individuals pale grey, which owing to iridescence appears silvery, with pink cirri—a pale but decided pink. This one is mature, and contains eggs.

The tentacular cirri are arranged, as Willey has described, and as Ehlers has confirmed; the longest reaches to the 10th or 12th segment, the second ventral is about half this length. Although Langerhans wrongly allocates these cirri in his text, yet his figure seems to show their distribution quite clearly, and is more informative than Willey's figure.

The pharyngeal papillæ have the characteristic arrangement, which is very evident in one of our specimens, in which the pharynx is everted.

Localities.—
Station B, 25 fathoms.
Station D, 45-50 fathoms. Distended with eggs.
Station 8, 120 fathoms.

Distribution.—Madeira (Langerhans), Juan Fernandez, South Georgia, Kaiser Wilhelm II Land (Ehlers), Cape Adare (Willey).

Remarks.—This is rather a remarkable range, and the much larger dimensions of these Antarctic specimens raises the question as to the specific identity, which is mainly upheld by the characteristic arrangement of the pharyngeal papillæ. Another species, *P. medipapillata*, described by Moore (1909, p. 237), also has the median row of 4 or 5 papillæ, with six lateral rows on each side, containing 9 in the ventral and 12 in the dorsal rows. This occurs on the coast of California.

Genus EULALIA *Savigny*.

EULALIA CHARCOTI *Gravier*.

Gravier (1911), p. 57, pl. I, figs. 14–16 ; pl. II, figs. 17, 18.

Eulalia charcoti lives in comparatively deep water, our specimens coming from depths of 110–318 fathoms, and Gravier's from 210 fathoms (approx.).

The preserved specimens have a dark greenish-blue body with brownish-green cirri ; the body is highly iridescent, and in one individual the effect produced is a bronzy green colour.

Two of them have a dark blue band along the middle third of the dorsum, with a green iridescence ; the lateral thirds being russet brown, and the cirri olive green. The whole effect is very beautiful. Gravier states that in life the worm is " emerald green with blue iridescence." There is but little to add to his account.

The longest of our specimens measures 150 mm. by 6 mm. across the body, which is larger than Gravier's largest. The longest of the tentacular cirri, belonging to the second segment, is 8 mm., and reaches to the 23rd segment, the next one is only 5 mm. long, and reaches to the 15th ; the others are about half the length of the latter. These measurements are taken from a specimen 95 mm. long, with a diameter of body 5 mm.

The pharynx is everted in one individual, and shows the characteristic arrangement of the papillæ, unusual in the genus, namely, six longitudinal rows of curved brown-edged papillæ, united basally by a broad continuous band of smaller rounded ones, and distally by a girdle of similar papillæ. There are about 50 small close-set papillæ at the entrance—an unusually large number.

Localities.—

Station 2, 318 fathoms (one).
Station 3, 157 fathoms (one).
Station 8, 120 fathoms (four).
Station 12, 110 fathoms (one).

Distribution.—Admiralty Bay, South Shetlands, in 420 metres (approx. 210 fathoms), (Gravier).

Sub-genus PTEROCIRRUS *Claparède*.

EULALIA (PTEROCIRRUS) MAGALHAENSIS *Kinberg*.

Kinberg (1865), p. 241.
Ehlers (1901), p. 73, pl. VIII, figs. 1–8.
Gravier (1906), p. 25.
Ehlers (1912), p. 13.
Gravier (1911), p. 56, pl. I, figs. 12, 13.
Fauvel (1919), p. 364 (gives several synonyms).

An imperfect individual, consisting of the anterior end of about 65 segments, appears to belong to this species. It measures 20 mm. in length and 2·5 mm. in width.

Most of the cirri are broken ; the colour is yellowish brown, with dark greenish-blue patches, more or less extensive, irregular in shape and size, arranged along the dorsum ; they may be due to post-mortem changes.

Of the tentacular cirri only one, on the left side, and two on the right, remain. But the general agreement of the head, the parapod and the chætæ, with the account given by Ehlers, inclines me to place the worm in this well-known Sub-antarctic species.

Locality.—
Macquarie Island, rock pool.

Distribution (In the Antarctic and Sub-antarctic regions).—Magellan region (Kinberg), Fuegia, Chilian coast, Kerguelen, Kaiser Wilhelm II Land, Coulman Island (Ehlers), Biscoe Bay, Petermann (Gravier).

Eulalia (Pterocirrus) hunteri*, *sp. nov.*

(Plate 7, figs. 48–52.)

The single individual is complete ; it measures 165 mm. in length, by 2·25 mm. over the body, and 6·5 mm. over the dorsal cirri, which are directed outwards. Anteriorly the diameter of the body is but 1 mm.; the greatest breadth is about 20 mm. from this end, and is retained for rather more than one-half the total length, whence the body tapers gradually. This breadth of body is equal to 4½ segments.

The colour of the body is flesh-pink, with a pair of very dark blue, nearly black, irregularly quadrate spots on each segment about midway between the mid-dorsal line and the lateral margin (fig. 48). These spots commence at the 9th segment. In the hinder quarter of the worm they extend medially till they meet, so that these segments are crossed by a series of dark bands.

The dorsal and ventral cirri are yellowish ; the ventral surface is of the same colour as the ground tint of the dorsum.

The body is convex dorsally, flat ventrally; the parapods are short, and the dorsal cirrophore is close to the body. The dorsal cirri are of considerable size, nearly as long as the body breadth, and are not relatively shorter on the anterior segments.

The prostomium is colourless, its breadth is rather greater than the length (fig. 49), and a slight notch on the posterior border, and also at the level of the insertion of the tentacles, gives it a trefoil shape.

* I take this opportunity of associating with this handsome annelid the name of Mr. J. G. Hunter, the able biologist of the Expedition.

The eyes are brown; the median tentacle springs from the dorsal surface in front of the level of the eyes; it is more slender than the anterior tentacles, and about as long as the length of the prostomium. The two pairs of anterior tentacles have the usual position and shape, and are shorter than the median.

The first segment is distinct dorsally, behind the prostomium, and is of the same width. It bears on each side one comparatively short tentacular cirrus, which has the same form as the tentacles, but is stouter. The second segment carries two tentacular cirri on each side, the dorsal of which is sub-cylindrical and long, while the ventral is shorter, wide and distinctly foliaceous, produced into a short filamentous point. It is longer than the normal dorsal cirrus, to which, however, it bears a resemblance.

The third segment bears a long sub-cylindrical dorsal tentacular cirrus, longer than that of the preceding segment; below it is the chætigerous lobe and a small foliaceous ventral cirrus.

These long tentacular cirri are not, in reality, circular in section, but more or less compressed. The longest of them reaches to the 15th segment; it is 2·25 mm. in length. It may be noticed that these anterior segments are shorter than those that follow, the increase in length being gradual.

The parapods (fig. 50) are short, with the anterior lip longer than the posterior. The foliaceous dorsal cirrus is broad, as wide as its length, with an asymmetrically situated apex; the cirrophore is close to the body wall. The ventral cirrus is oval, not pointed, about as long as the chætigerous lobe.

The chætæ (fig. 51). The shaft is a great deal wider than the appendix, and of a much higher degree of refringency, so that at the junction between the two there is a very marked transition when viewed under the microscope. The articular cup is strongly "heterogomph" and, as usual in the family, is very narrow; one lip is very short, the other is produced into a long curved claw-like structure, both are smooth, and present no striations. The appendix is relatively short; its proximal end is narrow, but soon acquires its full breadth, and then rather rapidly dwindles, to be prolonged into a very fine distal portion. It is very thin even in the lower portion, and is obliquely striated along its whole length; and its concave edge is faintly but distinctly denticulate.

The pharynx was exposed by dissection; the buccal region extends through 25 segments, and the pharynx occupies nine more, *i.e.*, its hinder end reaches to the 42nd. At its entrance are 16 small conical papillæ. The buccal cavity is lined uniformly with closely set, round-topped, nearly cylindrical papillæ, slightly narrower at the base than at the apex, and about 3 times as high as broad (fig. 52). They are practically of uniform size and shape throughout. In the everted condition the pharynx, therefore, would be said to be covered with these papillæ.

Locality.—

Commonwealth Bay, Station 12, 110 fathoms.

Remarks.—It agrees with *Eulalia magalhænsis* Kinberg, in the form of the head and in the position of the median tentacle; but differs from it in the arrangement and length of the tentacular cirri, in the shape of the dorsal cirri and of the parapods, and especially in the form of the chætæ. The marked ungulation of the articular cup recalls that figured by Ehlers (1904, pl. II, fig. 9), for *E. microphylla* Schmarda, from New Zealand, in which, however, it is much less pronounced, and which differs in other respects of course.

EULALIA (PTEROCIRRUS) MCLEANI,* *sp. nov.*

(Plate 7, figs. 52–57.)

Two specimens in the collection appear to be new. The one studied in detail measures 45 mm. in length, with 115 segments. The breadth of the body, which is equal to the length of six segments, is 2·25 mm., and over the parapods 4 mm. The peristomium is 1·5 mm. across, and the body gradually widens till at about one-quarter of the body length it attains 2·25 mm. in width; this is retained for about another quarter, when the body commences to taper.

In the second individual the pharynx is everted, and the body is a good deal contracted anteriorly; this contains 120 segments with a small regenerated region. Its length is 32 mm., its greatest width 4·25 mm.

The colour of the body is a uniform pale brown with a dull greenish-yellow cirri, which when pressed back over the body reach nearly to the middle line. Those of the anterior segments are not much smaller than the rest, which are practically uniform in size.

The prostomium (fig. 53) is broader than long, trefoil shaped with a slight notch posteriorly. The eyes are large, and separated from one another by a space rather greater than their diameter. The median tentacle arises far back, between the eyes, and is thus close to the hinder margin; it is a good deal longer than the prostomium. The lateral tentacles arise in the usual position; they have the shape of a long cone, constricted at the base with the apex produced to a point.

The tentacles and cirri are quite pale, and possibly are yellowish in life.

The first and second segments are distinct dorsally, the longest tentacular cirrus reaches to the 14th segment, the other three are about half this length. The three upper cirri are circular in section, but the ventral cirrus of the second segment is flattened from in front backwards, higher than it is thick, so as to be foliaceous. Its apex is produced into a longish filament.

* I wish to associate with this animal the name of Dr. A. L. McLean, who did such useful service in collecting at winter quarters.

The parapods (fig. 54) are very short and rather high, the foliaceous dorsal cirrus is long and narrow; its length is more than twice its width; its apex is symmetrically pointed, its base is short and springs from the chætigerous lobe close to the body. The ventral cirrus is comparatively large and of similar shape, longer than the chætigerous lobe.

The chætæ (figs. 55, 56) are comparatively few in number; the lip of the articular cup is finely serrated on one side, smooth on the other; and the two lips are approximately of equal height; the appendix is long, narrow, straight, flexible and tapers gradually to a fine point; its edge is finely serrated.

The pharyngeal apparatus was everted in the larger of the two specimens, though the buccal membrane or pharyngeal sheath is ruptured at its base. The length of the pharynx is 15 mm., with a diameter of 3 mm. at its anterior end. The aperture is surrounded by 24 rather large papillæ, set as usual at the ends of ridges leading into the interior. The buccal membrane is uniformly covered with closely-set unequal, flattened, club-shaped papillæ, giving it a velvety appearance (fig. 57). They are much smaller than those of the preceding species.

From a study of the other specimen it appears that the intestine commences at about the 34th segment, so that the buccal and pharyngeal regions together must be 10 mm. in length.

Locality.—

Commonwealth Bay, Station 1, 350-400 fathoms.

Remarks.—I suspected that this worm was *E. magalhaensis*, the only specimen of the genus hitherto recorded from these latitudes, but from it the present worm differs in the larger eyes, in the position of the median tentacle; in the much greater length of the tentacular cirri; in the form of the appendix, and in the character of the articular cup; and in the number and shape of the pharyngeal papillæ.

Genus ETEONE *Savigny.*

ETEONE REYI *Gravier.*

Gravier (1906), p. 26, pl. III, figs. 24–26; (1911), p. 60.

Ehlers (1913), p. 457.

A single individual of this small Phyllococid was found on a slide on which I had mounted some Syllids collected in Commonwealth Bay.

It is but 5 mm. long, and consists of head, 26 chætigerous segments and the anal segment.

I find that the prostomium differs from Gravier's figure in that it is produced forwards as a narrower plate than the basal oculiferous region. This I take it is what Ehlers means when he says that his specimen has a " spatelartig " prostomium.

The absence of any dorsal cirrus above the first chætigerous lobe serves to differentiate the species.

The dorsal cirri along the middle and hinder portions of the body are coloured reddish brown by little spots of pigment, and similar though smaller spots occur in groups along the back.

Locality.—
Commonwealth Bay. No data.

Distribution.—Port Charcot (Gravier), Kaiser Wilhelm II Land (Ehlers).

Sub-family LOPADORHYNCHINÆ.

Genus PELAGOBIA *Greef.*

PELAGOBIA VIGUIERI *Gravier.*

Gravier (1911), p. 62, pl. II, figs. 22–25.

(Plate 7, figs. 58–60.)

Numerous individuals of this small pelagic worm were obtained in tow-netting in January, 1914, in depths from 45 to 100 fathoms, when the water was far below freezing point. One vial is marked "Temp.— 0.5° C."; another "Partly ice." Mixed with them was *Tomopteris septentrionalis.*

The length varies from 5–12 mm.; the head is followed by 21–25 segments, the larger ones being sexually mature, containing eggs or sperm morulæ.

Gravier's account, founded on only three specimens, agrees precisely with the present worms, but for one apparent omission. He has overlooked the existence in the long metastomial cirri of a chitinous supporting axis.

He correctly describes the first segment, which immediately follows the "head," as possessing on each side a very long dorsal and ventral cirrus, separated by a small bundle of compound chætæ, such as occur throughout the worm. Each cirrus presents a swollen base, and has a much thickened cuticle on its posterior face (figs. 59–60). This cirrus is traversed nearly throughout its length by a delicate chitinous aciculum or thread of chitin. It starts at the apex of the cirrus, and just before the swelling is reached it tapers to a very fine point.

This axial support is so evident in specimens mounted in glycerine, as well as in balsam, that it is astonishing that no mention of it is made by Gravier.

Locality.—
Commonwealth Bay, 45 faths., 50 faths., 100 faths.

Distribution.—Lat. 69° 15′ South: long. 108° 5′ West, at a depth of 950 metres.

83892—H

Remarks.—Gravier points out certain differences that exist between his species and *P. longicirrata* Greef. Unfortunately I have not access to Greef's paper, as the volume is missing from my series of the Zeit. f. Wiss. Zool. And, although the species has been recorded from most of the Antarctic expeditions no details or figures are published that enable me to judge of Gravier's statements in this respect.

The only figure relating to the species, which is available to me, is that given by Southern (1909, pl. I, fig. 1) of the chæta; and his statement on p. 2, that the appendix of all the chaetæ has "on the posterior side a delicate wing-like expansion." This is certainly not present in the species before me, and, moreover, the length of the appendix is longer and slenderer than it is in that figure, and is in entire agreement with Gravier's figure.

Family ALCIOPIDÆ.

Genus VANADIS *Greef.*

VANADIS ANTARCTICA *McIntosh.*

Alciopa antarctica, McIntosh (1885), p. 175, pl. XXVIII; figs. 2–4; pl. XXXII, fig 12.

Vanadis antarctica, Apstein (1890, p. 543 (not seen).

V. antarctica, Willey (1902), p. 271, pl. XLIV, fig. 8; pl. XLVI, figs. 1, 2.

?*Alciopa antarctica*, Gravier (1911), p. 65, pl. II, fig. 26; pl. III, fig. 28, 29; pl. IV, fig. 38.

V. antarctica, Ehlers (1913), p. 466.

(Plate 8, figs. 61–63.)

My excuse for describing once again this Antarctic species is that Gravier has thrown doubts on its generic position, and that the previous accounts are imperfect in some respects.

The material obtained consists of two specimens, a male and a female, which were captured on the surface of the sea by Dr. A. L. McLean; and some smaller individuals from 45 fathoms.

Dr. McLean notes that they are "transparent, mottled with brown." The female is entire, measures 135 mm. in length, its greatest breadth is 5 mm., at about mid-body. There are 93 segments, followed by a short regenerated region, 4 mm. in length, of very small segments.

The prostomium is 3 mm. across, and the anterior part of the body is very narrow, only 1·75 mm., the head and this narrow region, or "neck," occupy a length of 11 mm.

The dorsal surface of the head and neck is pale brown; the rest of the body is of the same tint, with darker brown markings at the base of each parapod, both above and below; at irregular intervals along the body this deeper tint extends further over the surface, both dorsally and ventrally, forming larger and smaller areas, which nearly meet on the dorsal surface.

The male is imperfect, consisting of head and 56 segments, with a length of 65 mm. As Gravier has pointed out, the glands below the parapods are much better developed than in the female, and I note a series of segmental white marks along the median ventral line which are better developed in the hinder part of the fragment than anteriorly. These are not present in the female.

The anatomy of the worm agrees both with the account given by Willey and the more complete one by Gravier, except that the latter states that the colour of the specimens gathered by the French expedition, when alive was " vert jaunâtre," and that the spots were " vert épinard foncé."

There is, however, one important difference between these two accounts. Willey found, contrary to McIntosh's statement, that the bristles are " articulated," though he found it difficult to detect the articulations, till the bunch of chaetæ was " sp.ead out." Gravier, on the other hand, insists that they are " entire," and consequently expresses doubts as to the identity of Willey's specimens with that described by McIntosh and by himself. He enumerates three points of difference—namely, (1) in regard to the chaetæ; (2) in regard to the absence in Willey's account of any description of the dorsal surface of the head; and (3), in regard to the papillæ at the entrance to the pharynx.

I will offer remarks on each of these points, and hope to clear up the doubts expressed by him.

(1) For some time I was unable to detect any articulation in the chaetæ. I followed Willey's advice to " spread them out," but failed at first to see any sign of jointing, even under high power. But chancing to shift the mirror of the microscope so that the light was no longer fully reflected, I noted an extremely faint and very oblique line crossing the very delicate and transparent bristles. This " jointing " is so unlike what one would expect from Willey's figure, the reproduction of which is coarse; it is so unlike the articulation that occurs, for instance, in *Halodora*, that it is easily overlooked. When viewed from the side the articulation, if one may call it so, has the appearance of a very oblique interruption in the chaetal substance, which does not seem to reach the edges in all cases; but most of the appendices have the appearance of being " spliced " to the shaft, that is, it and the shaft are obliquely cut across (fig. 62). Occasionally, one finds a chaeta lying in a different plane, and the splicing appears to be more perfect and definite, where the distal appendix has its base sliced off on both sides to a point, and this fits into a V-shaped cut at the end of the shaft (fig. 63).

Having once recognised the position of the articulations, one can see a bending of the bristles, forming an open angle, which might be taken for a mere " bend " till the existence of the articulation was ascertained.

Even when I had satisfied myself of their existence, I found it very difficult to detect these articulations in specimens mounted in glycerine jelly, even by the use of a high power, but it is easy to see them in fresh glycerine. I re-examined specimens mounted in glycerine, twelve months later, and saw the articulations quite clearly in every chaeta.

The length of the appendix is small, compared with the total length of the bristle. I had some difficulty in estimating what its length is, since the bristle is so long that it will not lie wholly in the field with an objective 3 and ocular 3 of Leitz, and a lower magnification is useless. By a fortunate chance a small air bubble occurred in the preparation about half way along one of the bristles, so that by making two camera drawings I was able to get practically the entire bristle, and was thus able to measure it. The total length is represented in the drawing by 570 mm., and the appendix by 10 mm. approximately, for its tip is so fine that under this magnification it is invisible. Roughly, one may say that the length of the appendix is about $\frac{1}{60}$ of that of the total (fig. 61). It may be noted that McIntosh says that " none of the extremely attenuate tips are complete." So that there is no real contradiction between his account and that of Willey. It is probable that all the appendices had dropped off or been broken off in the specimen, as is the case in many of the chaetæ in those before us.

(2) The second point is explained, I think, by the fact that McIntosh had represented in his figure the head from the dorsal aspect, and Willey drew attention to the structure of the ventral aspect, in order to complete the description of the species, as McIntosh had not given an accurate figure of this surface.

(3) The third point is, I believe, due to an error in observation by Gravier himself. Willey states that in the everted pharynx the entrance is surrounded by twelve soft conical papillæ. In the specimen described by Gravier the pharynx was not everted; he states that it extends backwards as far as the 20th segment, where it is bent upon itself. He goes on to say (p. 68): " Le bord de l'orifice postérieur est froncé, mais ne présente pas ni papille definie, ni prolongements digitiformes."

He omits to mention the buccal region. Now, of course, the papillæ being at the entrance of the pharynx from the buccal region must be looked for, not at the posterior extremity, but at the anterior extremity of the pharynx when at rest inside the body.

I dissected the male individual and find that the buccal region is very short, extending to about the 5th or 6th segment, including the peristomium; then follow the long " trompe très musculeuse," which reaches to the 20th segment; then it bends upon itself and reaches forward to the 15th segment, where it enters the thin-walled intestine. On slitting open this apparatus I find at the anterior extremity of the pharynx or " trompe " the series of papillæ described and figured by Willey.

The weight of evidence, then, appears to be against Gravier's contention that this species belongs to the genus *Alciopa*. McIntosh had already noted the "short filiform cirrus at the end of the foot." Gravier himself recognises that it "approaches the genus *Vanadis*" on this account, and points out that only in the absence of the prehensile organ at the entrance to the pharynx and in the form of the chaetæ does it differ therefrom. As he himself considers the form of the chaeta as the "dominating" character of distinction, Apstein's contention and Willey's support of it are surely justified, and the only possibility left is that Gravier is dealing with a different species from those obtained by the "Challenger," the "Southern Cross," and the "Aurora," which, I think, is not probable.

Locality.—

Commonwealth Bay, surface, and at 45 faths.

Distribution.—Antarctic Ocean, practically circumpolar (McIntosh, Ehlers, Gravier, Willey); Atlantic Ocean, near Ascension (Ehlers); North Pacific and Indian Oceans (Apstein).

Family TOMOPTERIDÆ.

Genus TOMOPTERIS *Eschcholtz.*

Sub-genus TOMOPTERIS *Rosa.*

TOMOPTERIS CARPENTERI *Quatrefages.*

Quatrefages (1865), vol. ii, p. 227, pl. XX, figs. 1, 2.

? *T. carpenteri*, McIntosh (1885), p. 531.

(Plate 8, figs. 64–66.)

A very well-preserved, complete individual was obtained in the tow-net by Dr. McLean in 45 fathoms of water among the pack ice; and four others, less well preserved, came from 50 fathoms, during January, 1914.

The description applies to the first-named specimen. It is 55 mm. in length, with a maximum diameter of 13 mm. over the parapods in the mid-body. It is 7 mm. across the first pair. The total width gradually increases till the middle of the body, then decreases to the hinder end. The body itself measures 4 mm. across, at about the middle, but is only 2·25 mm. at the neck, in front of the first parapod. There are 33 pairs of parapods, the last 2 or 3 being very small. The same number occurs in a less well-preserved specimen, which is only 35 mm. in length by 8 mm. over the feet.

The anterior parapods are short. They gradually increase in length up to the 6th, and this maximum length is retained till about the 14th, when they decrease.

The worm is opaque in the preserved state (in formaline). The colour is pale brown with a darker band along the mid-dorsal and mid-ventral lines. In the shorter specimen there are two areas of deep brown across the ventral surface of the body and

parapods, extending over the anterior third and over the hinder third of the body. Whether these are post-mortem or not I cannot say. The head and posterior end as well as the middle third are quite pale.

There is no trace of a " tail."

The prostomial cornua (fig. 64) are carried on a very short, wide base. The anterior margin has no median notch, and the frilled membrane is continuous from side to side. The extremities of the cornua are gently curved backwards, and reach to the outer ends of the enlarged bases of the long cirri.

The ciliated epaulettes are very distinct, narrow, slightly curved, with the convexity mediad. They commence at the anterior margin and reach about halfway along the dorsal surface of the head, terminating in a depression of its surface. In a less well-preserved specimen the epaulettes assume a more or less triangular form, with the base external and one angle mediad, that of the left side especially resembles Quatrefages' figure (pl. XX, fig. 1).

The dorsal surface of the prostomium—that is, the middle region of the " head "—is convex, and rather browner than the neighbouring region of the body; it is bounded laterally by a pair of deep, longitudinal depressions, which separate it from the cirrus bases on either side.

No eyes are visible in this individual; but they are present in the smallest specimen, which was stained and mounted in balsam.

There is no sign of the " first cirrus " which occurs in some species.

The " second cirrus " is at least 18 mm. in length, and reaches to at least the 15th segment. It is very delicate, breaks easily on being manipulated. The cellular envelope is missing in the distal portion, and the protruding, very transparent chitinous axis is difficult to trace under a dissecting microscope. It is thus difficult to state exactly the length of this cirrus. But in the larger of the less well-preserved specimens the cirrus is seen to extend to the hinder end of the body; so that this may, I think, be regarded as its normal length. The base of the cirrus is nearly hemispherical, with a somewhat pointed apex externally, whence the cirrus arises. The longitudinal diameter of the base is about equal to its transverse, and this is greater than the width of the prostomium. The diameter of the " head " across the cirrus bases is 5·5 mm.

Between the base of the cirrus and the first pair of parapods the gap is longer than that separating the subsequent feet. The length of this gap or " neck " is equal to the diameter of the body at this point.

The distance separating the successive parapods is about half the basal length, but in the poorly-preserved specimen the feet are closer together.

At their greatest development the length of a parapod is greater than the width of the body, but at either end of the series this difference decreases.

The dorsal ramus of the foot (fig. 66) is rather shorter than the ventral, and the two diverge at an angle which approaches 90°. Indeed, in less well-preserved specimens, this angle is a right angle. The end of each ramus is bluntly pointed and appears brown, especially in those cases in which the membrane has been torn away. The " pinnal membrane " is characteristically developed, and resembles that of *T. nisseni* Rosa. On the dorsal surface it commences on the base of the foot, some distance proximad of the bifurcation; its line of origin is undulating, as also is its margin. The membrane continues round the apex, and only ceases at the angle formed by the two rami. The arrangement of the ventral pinnal membrane is similar, but it is more extensive. It bears two " pinnal glands," which are termed by Rosa the " hyaline " and the " chromophil " glands.* There is no " rosette." The species, therefore, belongs to Rosa's sub-genus *Tomopteris*.

The " hyaline " gland is capped by a dark orange or red brown mass of pigment, and is situated just dorsal of the apex of the ventral ramus. It makes its first appearance on the 3rd foot.

The " chromophil " gland (the " cupule " of Quatrefages) appears as a rounded glandular thickening, differing in texture, as in its pale buff colour, from the surrounding transparent membrane. These glands commence on the 5th foot, and are recognisable as far back as the 20th, beyond which I am unable to detect them.

The two larger specimens are males, and the young testis is situated in the dorsal lobe of the foot, along the roof of its cavity.

Locality.—

Commonwealth Bay. Pack ice.

Distribution.—Antarctic Ocean, lat. 60° 3′ South, long. 0° 60′ (Quat.). Between Kerguelen and Macdonald Islands (McIntosh).

Remarks.—This species formed the basis of Quatrefages' account of the genus in his " Histoire Naturelle des Annelés," and his account has been repeated, though recast, by Rosa (1908, p. 312) in his useful monograph of the genus. Quatrefages' specimen had been collected during the voyage to the South Polar Regions of the *Zelée* (1837–1840), though it is not mentioned in the reports of that voyage. The specimen was imperfect, lacking the hinder end and the long cirri. It is described as being opaque and " maroon coloured " (which agrees probably with the present specimens). Owing to the imperfections of the type, I have deemed it worth while to enter pretty fully into detail, for the species has not been examined or reported upon since 1865. Quatrefages, in his figure of the " head " (pl. XX, fig. 1) shows the epaulettes as triangular, and, as I have mentioned, it is so when the animal is ill preserved. The foot (Quat., fig. 2) is possibly somewhat distorted, as the angle made by the two rami is greater than it is in well-preserved material. Here, again, I

*Though the gland takes hæmatoxylin very strongly, it is not noticeably affected by alum carmine, which I used.

find that ill-preserved specimens are more nearly like Quatrefages' figure. In short, the present specimens agree precisely with his account of the species, whether under the description of the genus (p. 219) or of the species (p. 227).

There is, I think, strong justification for McIntosh ascribing to this species those specimens that occurred in considerable numbers in the neighbourhood of Kerguelen. It is true he gives no details whatever, and Rosa has suggested that perhaps he had *T. eschcholtzi* Quat., before him. This occurs near the Cape of Good Hope, and the suggestion was, no doubt, warranted. But in view of the fact that *T. carpenteri* was originally found in the neighbourhood of Bouvet Island and now at almost the exact opposite quarter of the Antarctic seas there is no geographical ground for refusing to accept McIntosh's identification.

TOMOPTERIS SEPTENTRIONALIS *Quatrefages.*

Quatrefages (1865), vol. ii, p. 229.
Rosa (1908), p. 297, pl. XII, fig. 17.
T. (*Johnstonella*) *septentrionalis*, Gravier (1911), p. 72 (full list of references).

About a dozen specimens of this bi-polar species were gathered by tow-netting during January, 1914, at depths from 45–100 fathoms. They vary in length from 5–15 mm.

Gravier has already pointed out that in his specimens the length of the peristomial cirri exceeds that given by Rosa, who states that they are about $\frac{2}{3}$ the body length. It appears possible that this varies with age, for I find that in one that is 8 mm. in length the cirri are longer than the body. The specimen was mounted, and the cirri fortunately lay directed backwards. In one of 15 mm. they are at least 10 mm. long, and have every appearance of having been broken. Southern gives the length as from "one-half to four-fifths" of the body length (1911, p. 21).

As previous observers have stated, the hyaline glands are difficult of detection in all the segments in which they occur. I find them in the first three parapods distinctly and in at least 12 of the subsequent parapods, though they are not readily visible ir all the feet of every specimen.

The eyes are brown, rather far apart, and situated far forwards, just in front › the bases of the cirri.

Surely it is by a *lapsus calami* that Gravier places this species in the sub-genus *Johnstonella*, for it has, according to the observations of Apstein, Rosa, and myself, neither rosette nor first cirrus nor tail; and Rosa himself places it in the sub-genus *Tomopteris* on this account.

Localities.—

Commonwealth Bay, 45 fathoms, 50 fathoms, 100 fathoms.

Distribution.—North Atlantic; Baltic; North Sea; S.W. Coast of Ireland (Southern); Pacific (Apstein); lat. 69° 15′ south, long. 105° 5′ west (Gravier).

Family NEREIDÆ.

Genus Nereis *Cuvier.*

Nereis loxechini *Kinberg.*

Nicon loxechini, Kinberg (1865), No. 2, p. 178.

Nereis loxechini, Ehlers (1908), p. 73.

Nereis loxechini, Ehlers (1913), p. 497.

(Plate 8, figs. 67–75.)

This is evidently a rare worm, and the only species of *Nereis* (other than *N. uncinata* Ehlers) recorded from the Antarctic region. Up till 1908 it had not been met with since Kinberg's record of it at Magellan Strait. In that year Ehlers published a brief description of a small individual obtained from St. Paul's Island; the only one collected by the expedition. In his later memoir he records a larger specimen, measuring 77 mm. by 6 mm. across the body, and containing 86 segments, from Kaiser Wilhelm II Land. It was noted as being " red-brown in colour " when alive. He, however, added no new facts about the species.

As no figures have been published (unless they are contained in Theel's new edition of Kinberg's work, which I have not been able to consult), it seems desirable to add another and more detailed illustrated account of the species.

Three specimens were gathered by the " Aurora," in depths from 157 to 325 fathoms; all are more or less imperfect. The most nearly complete individual has a length of 60 mm. and a breadth of 6 mm. over the parapods, and 5 mm. over the body anteriorly; thence it tapers, so that at about the middle of the body these measurements are 4 and 3 mm. respectively.

This worm consists of 132 segments, and only lacks a few of the hindmost. Another fragment represents a larger individual; it consists of the head and 45 segments, and measures 40 mm., with a breadth of 5 mm. over the body, and 7 mm. across the feet.

The third specimen is rather soft; it is 26 mm. by 3 mm. over the body, and 4 mm. over the feet. The hinder end of the fragment, whose segments I did not count, is 1·25 mm. across the body.

The dorsal surface is brown, more deeply tinted over the middle area, with a pale line across the anterior margin of each segment; the lateral areas are almost white ; the parapods are brown, with two glandular masses of greyish-brown at their bases. The tips of the ligules are similarly tinted.

The prostomium (fig. 67) is broader than long; the posterior oculiferous region is rather abruptly marked off from the narrower tentacular region in the well preserved specimen, but not so much in the less well preserved (fig. 68). The eyes are large, each with a well developed lens; the posterior eye is oval rather than circular, with the long

axis slightly oblique to a transverse line; they face upwards and backwards. The anterior pair, of which only the upper half is visible from above in this specimen, faces forwards and outwards. The posterior pair is close to the hinder margin, the anterior separated from them by about the diameter of an eye.

The tentacles are about half the length of the prostomium in one case; nearly equal to it in the less well preserved specimen. The palps are broad and short, with a nearly spherical appendage, and do not reach further forwards than the tips of the tentacles, or only slightly further.

Of the peristomial cirri, the longest, *i.e.*, the anterior dorsal, reaches back to the 7th or 9th segment, and is from 8 to 10 mm. in length; the next, antero-ventral, is about half this length, and the other two are successively shorter, the shortest being of the same length as the prostomium *plus* its tentacles.

The peristomium is rather longer than the first chætigerous segment and about equal to the second; it has a straight anterior margin.

The parapods are relatively short: and present a peculiarity that I do not remember seeing noted in other species. The posterior lip of the neuropod is produced outwards into an ovate process, very distinctly constricted at its base, and though normally directed outwards, is sometimes displaced backwards. It occupies the position of one of the foliaceous outgrowths characteristic of the Heteronereid stage of some species (fig. 69).

In the anterior feet, up to about the 22nd, the upper ligule is bluntly pointed, no longer than the dorsal lip or " middle ligule." The lip of the ventral lobe is bluntly rounded and carries, as I have mentioned, the curious appendage on its posterior face. The ventral ligule is rounded and shorter and broader than the ventral lip, and this seems to be a specific character (fig. 70).

Posteriorly, at or about the 34th foot (fig. 71), the upper ligule becomes rather more pointed, as does also the middle ligule; the ventral ligule remains broadly rounded, and is even larger than anteriorly.

In the still more posterior feet (fig. 72) this ventral ligule is still more noticeable as a large rounded lobe, larger than any of the other lobes.

The chaetæ are arranged as follow in the anterior feet:—

Dorsal bundle.—About 12–15 spinigerous homogomphs, with long slender appendix.

Ventral bundle.—(a) Supra-acicular group: 6–8 spinigerous homogomphs, as above, together with 3–4 stout-shafted, brown, falcigerous heterogomphs with a shorter appendix.* (b) Sub-acicular group: A few spiniger homogomphs and 16–18 heterogomph falcigers with slender colourles shaft.

* The appendix is short only as compared with that of the homogomphs; it is longer than the usual short falciger.

The brown, stout heterogomphs are absent in the anterior feet of the specimen from 157 fathoms. Is it a sexual mark ?

In the 20th and subsequent feet the number of these stout bristles is reduced to two.

The appendix of the heterogomphs (figs. 73, 74) is knife-blade like, with long fine hairs along its edge. The tip is hooked, and from the end an oblique line indicates the margin of the " guard."

The pharynx is peculiar in having no paragnaths, either in the oral or in the maxillary divisions. The jaw (fig. 76) has sixteen rounded teeth, of which the five distals are concealed by the brown edge of the jaw, as it lies on its side.

Locality.—

Commonwealth Bay. Station 2, 318 fathoms (one); Station 3, 157 fathoms (one); Station 10, 325 fathoms (one).

Distribution.—York Bay, Magellan Strait (Kinberg) ; East of St. Paul Island, 367·3 fathoms ; K. Wilhelm-II Land, 210 fathoms (Ehlers).*

NEREIS AUSTRALIS *Schmarda.*

Heteronereis australis Schmarda (1861), p. 101, pl. XXXI, fig. 242.

Platynereis magalhaenis Kinberg (1865), No. 2, p. 177.

Nereis Australis Benham (1909), p. 238, pl. IX, fig. 1.

For a full synonymy and literature see Benham (1909, p. 238) and Fauvel (1916, p. 484). The latter zoologist does not take the view put forward by myself that Schmarda's species is synonymous with Kinberg's. I have gone into this matter pretty fully in the above-mentioned article and I am still of opinion there expressed, although Ehlers does not seem to have noticed the discussion, and has expressed no opinion as to it in any of his recent works.

Specimens of the worm were collected at various spots on the Macquarie Island by Mr. H. Hamilton, to the number of sixty or more. He found it in rock pools, &c.; it appears, therefore, to be a littoral species. Some of the specimens are filled with reproductive cells, either male or female; but they exhibit no heteronereid changes.

One male, preserved in formalin, has pale orange-brown colour, brighter anteriorly, with grey feet.

One specimen, at least, is still within its tube composed of black sand particles and small stones. Gravier has described such a sandy tube for *N. magalhaensis*.

A small individual, measuring 12 mm. in length, has paragnaths only in compartments IV next the jaws ; the rest of the buccal surface is bare.

* I have used Bell's estimate that one fathom is equal to 1·829 metres, as given in the "Discovery" Report : footnote, p. 4.

Locality.—

Macquarie Island (North End, Garden Bay, and West Coast).

Distribution.—Kerguelen, St. Paul, Magellan Region, Fuegia, Chili (Ehlers); Marion Island, Falkland Islands, Fernando Noronha (McIntosh); New Zealand and its subantarctic outliers (Benham); Puerto Madryn (Gravier); Table Bay, South Africa (Ramsay).

NEREIS KERGUELENSIS *McIntosh.*

McIntosh (1885), p. 225, pl. XXXV, figs. 10–12; pl. XVI A, figs. 17, 18.
Ehlers (1897), p. 65, pl. IV, figs. 81–93.
Gravier (1906), p. 29.
Ehlers (1907), p. 11.
Gravier (1911), p. 76.
Ehlers (1913), p. 495.
Ramsay (1914), p. 42.
Fauvel (1916), p. 433, with full bibliography.
Fauvel (1917), p. 203.

The present collection contained only two small specimens, in each of which the pharynx is protruded, allowing the characteristic arrangement of the paragnaths to be readily seen.

The species occurred with *N. australis* in rock pools, at low water.

Locality.—

Macquarie Island.

Distribution.—Kerguelen (McIntosh, Ehlers); S. Georgia (Ehlers); S. Orkneys (Ramsay); Falkland Islands (Fauvel); Tasmania (Benham); New Zealand (Ehlers); S. Australia (Fauvel); Canary Islands, Mediterranean (Marenzeller); Ile Booth Wandel, Petermann, Port Lockroy, Biscoe Bay, Admiralty Bay (Gravier).

Family NEPHTHYDIDÆ.

Genus NEPHTHYS *Cuvier.*

NEPHTHYS MACRURA *Schmarda.*

Schmarda (1861), p. 91.
N. virginis Kinberg* (1865), p. 239; Ehlers (1897), p. 19, pl. I, figs. 9–12.
N. trissophyllus, Grube (1877), p. 533; McIntosh (1885), p. 159, pl. XXVI, figs. 1–5; pl. XXVII, figs. 1, 4; pl. XXX, fig. 8; pl. XIV A, figs. 9–11.

* Kinberg writes "virginis" in his original account; Ehlers "virgini,"

N. macrura Ehlers (1904), p. 14.
N. macrura Ehlers (1908), p. 57; (1913), p. 451.
N. macrura Gravier (1911), p. 98.
N. macrura Benham (1915), p. 203, pl. XL, fig. 57.
N. macrura Fauvel (1916), p. 436, pl. VIII, figs. 1–3 (and adds *N. prætiosa* Kinberg as a synonym).

In 1897 Ehlers, from a study of the original specimens, showed that Grube's species is identical with that of Kinberg; and in his account of the New Zealand Annelids (1904) he further established, from an examination of the types, that Kinberg's species is synonymous with Schmarda's. He gave an extended and illustrated account of the species, which is widely spread over the subantarctic area. It is evidently very common, for the "Aurora" naturalists gathered some seventy specimens, varying in length from 14 mm. up to 125 mm., the latter with a diameter of 12 mm. over the parapods.

The worms are labelled as being "flesh coloured" in life, as I know from observation of our local specimens. In spirit, however, the dorsal surface becomes a pale brown and the parapods usually white.

The habitat extends from the shore-line, where it seems to be most abundant, to a depth of at least 157 fathoms, where it seems to attain its greatest size.

Localities.—

Boat Harbour—Shore: 2–4 fathoms; 25 fathoms.
Station 3, 157 fathoms.
Station 12, 110 fathoms.

Distribution.—South Chili (Schmarda); Magellan Strait (Kinberg); Kerguelen (Grube, McIntosh, Ehlers); Heard Island (McIntosh); Bouvet Island, New Zealand (Ehlers); Bass Strait (Benham); South Shetlands (Gravier); Falkland Islands (Fauvel).

Family AMPHINOMIDÆ.

Genus EURYTHOE *Kinberg*.

EURYTHOE COMPLANATA *Pallas*.

E. pacifica Kinberg—McIntosh (1885), p. 27, pl. II, figs. 3, 4; pl. III, fig. 2; pl. II A, fig. 13; pl. III A, figs. 5–9.
E. complanata Ehlers (1908), p. 38.

Ehlers* has shown that these two, as well as *E. alcyonia* Savigny, are identical, and discusses the history of the species. Fauvel (1919, p. 348) gives a list of the literature.

From the neighbourhood of Tasmania a young specimen was obtained measuring 11 mm. for 35 segments.

The distribution of the species is very wide, as it seems to occur in all seas and oceans.

* Ehlers, "Zur Kenntniss d. Ostafrikanischen Borstenwürmer" in Nachr. d. K. Gesell: d. Wiss. Göttingen. 1897, Heft. 2, p. 2.

Family EUNICIDÆ.

Sub-family EUNICINÆ.

Genus EUNICE *Cuvier.**

EUNICE TENTACULATA *Quatrefages.*

Quatrefages (1865), vol. I, p. 317.
E. pycnobranchiata McIntosh (1885), p. 294, pl. XXXIX, figs. 13–15; pl. XXI A, figs, 4, 5.
E. pycnobranchiata Benham (1915), p. 213, pl. XLI, figs. 79, 80.

Fauvel (1917, p. 209) has pointed out the resemblances in structure of these two species, and shows that they are identical. For other synonyms consult his article.

A single specimen of this Australasian worm was obtained by Professor Flynn (12th December, 1912).

Locality.—
Off Maria Island, Tasmania.

Distribution.—
Bass Strait (McIntosh, Benham), New Zealand (Benham), South Australia (Fauvel).

Sub-family LUMBRICONEREINÆ.

Genus LUMBRICONEREIS *Blainville.*

LUMBRICONEREIS MAGALHAENSIS *Kinberg.*

Kinberg (1864), p. 568.
L. magalhaensis Grube (1877), p. 531.
L. kerguelensis Grube (1878), p. 14 (separate copy).
L. kerguelensis Gr., McIntosh (1885), p. 246, pl. XXXVI, figs. 16, 17; pl. XVII A, fig. 18; pl. XVIII A, figs. 2–4.
L. magalhaensis Ehlers (1897), p. 74.
Ehlers (1901), p. 136.
Gravier (1906), p. 30.
Ehlers (1908), p. 99.
Gravier (1911), p. 78, pl. III, figs. 35, 36.
Ehlers (1913), p. 499.

The specimens before me agree almost exactly with McIntosh's account of *L. kerguelensis* Gr. Grube had tentatively assigned it to Kinberg's species, and Ehlers in 1897, having had the opportunity of examining both the types, found that they are identical.

* Leiper (1908) has enumerated a series of names of annelid genera which are already "occupied"; amongst others is *Eunice*. But it is so well established amongst Zoologists, while the insect to which it was originally applied is unknown to most of us, that no useful purpose would be served by discarding the name as now usually employed.

The existence of an independent flange below the pseudo-articulation of the hooded hooks in the anterior feet seems to be a characteristic feature of the species, and in some of the lower chætæ is a similar, but less developed flange on the convex side of the shaft.

There is, however, one point in which my specimens differ from the account given by McIntosh. I do not find, in the posterior feet, hooded hooks like that figured by him on pl. XVII A, fig. 18; they resemble, on the other hand, that which he attributes to *L. japonica*, and figures on pl. XVIII A, fig. 1. Has an error crept into the explanation of the plates?

The buccal segment agrees with that figured by Gravier (pl. III, fig. 35), as representing the adult condition of the species.

The specimens in this collection number four; one is imperfect and measures 80 mm. by 3 mm. This came from a depth of 325 fathoms. Of the other three from the Macquarie Island, one is mature and filled with eggs, rendering the body yellowish in colour; it consists of 133 segments, and measures 65 mm. by 2 mm. The remaining two are more slender, dark purplish-brown (in formalin), with a green iridescence.

Localities.—

Commonwealth Bay, Station 10, 325 fathoms (one).
Macquarie Island, shore (three).

Distribution.—Kerguelen (Kinberg, Grube, McIntosh); Magellan Strait (Kinberg, Ehlers), Fuegia, South Georgia, Falkland Islands, Bouvet Island, K. Wilhelm-II Land (Ehlers); Ile Booth Wandel, Port Charcot, Petermann, Admiralty Bay, South Shetlands (Gravier).

LUMBRICONEREIS MACQUARIENSIS, *sp. nov.*

(Plate 8, figs. 76–81.)

This anterior fragment of a small Lumbriconereid consists of a head and 56 segments, and measures 25 mm. by 1·25 mm.

It is greyish in colour, non-iridescent. The specimen is not well preserved, and is rather soft.

The prostomium is dark bluish grey, nearly hemispherical, with a median ventral furrow (fig. 76). The peristomium is interrupted by a buccal process of the second segment, and this process is grooved in the middle line; furrows also exist, cutting into the edge of the lateral portions of the peristomium. Its appearance, in short, is like that figured by Gravier for the young of *L. magalhaensis*, and also like Ehlers' figure for *L. sphærocephala*.

Were it not for further details, I should have referred it to the former species.

The parapods are very short, even anteriorly (fig. 77), with a rounded posterior lip, which does not project much beyond the anterior lip ; the length of which scarcely exceeds its height. Posteriorly the feet are even shorter (fig. 78). Each is supported by a single uncoloured aciculum ; the chætæ are very few ; of the capilliforms (fig. 81) I see only one in the 8th foot ; there are no roots embedded in the foot, so that it is not a question of breakage and loss. In the 25th foot there are none.

The hooded hooks are also few ; in the 8th only one is present ; in the 25th there are four; and at about the 45th three only.

These hooded hooks are, for the most part, without any articulation (fig. 80) ; the hood is strongly striated, and at its proximal region its edge is denticulated, some five or six distinct teeth being recognisable, at any rate in the 25th foot.

In the various preparations of feet from different parts of the worm I met with only one articulated hook ; it presents below the articulation a " ventral " independent flange (fig. 79), like that in *L. magalhaensis*.

The upper jaws recall those of *L. magalhaensis*, but the lower jaw plates are white, and resemble those of *L. sphærocephala*.

In the brevity of the feet it bears a resemblance to *L. brevicirris* Ehlers, and in this species, too, there are no articulated hooks, but the form of the hooks is very different, and the species differs from the present in other ways.

From *L. sphærocephala* Schmarda, of which I have studied local examples, the present species differs in having very much shorter feet ; in the early cessation of the capilliforms ; in the lack of articulation in the hooks ; in having a single colourless aciculum instead of three, of which one or more is dark brown ; and in the structure of the upper jaw plates.

Locality.—

Macquarie Island.

Genus OPHRYOTROCHA *claparède* and *Metschnikoff.*

OPHRYOTROCHA CLAPAREDI *Studer.*

Studer (1878), p. 119, pl. V, fig. 11.

Paractius notialis Ehlers (1908), p. 101, pl. XIV, figs. 1–6.

Paractius notialis Ehlers (1913), p. 500.

A very large number of specimens of this minute worm, which measures about 2–3 mm., were collected by Dr. A. L. McLean in Boat Harbour. He notes that when alive they are " pale, with dark patches dorsally." There is no pigment in the preserved worms, and it may be that he saw the black jaws through the transparent wall.

These worms agree with the account given by Ehlers of his species, which was founded on a single specimen. In his later memoir, however, he had a good number of individuals at his disposal, and he notes certain variations presented by them, such as the presence or absence of eyes, details in the form of the jaw apparatus, &c.

The species differs from the northern *O. puerilis* Claparède and Metschnikoff, in the absence of the ventral tentacles on the prostomium, and in the absence of the median anal cirrus, as well as in other details.

As long ago as 1888 De St. Joseph (p. 240), in describing the species *Paractius mutabilis*, raised the question as to whether *Ophryotrocha puerilis*, *Staurocephalus minimus* Langerhans, and *S. siberti* McIntosh, should not be ranged under the generic name *Paractius* Levinsen ; though it would have more in accordance with the usual practice to include the latter under the earlier title. In 1895 (p. 210) he returns to the question, and records his belief that Claparède's species is distinct from *P. mutabilis.*

Later, Bonnier (1893), in discussing Studer's species, notes that his account is "malheureusement insuffisant" owing to the fact that the material had been lost after the preliminary account had been drawn up. Bonnier suggests that it is probably a synonym of *O. puerilis*. He then considers the validity of Levinsen's genus, and concludes that it and the abovenamed species of *Staurocephalus* are all referable to the genus *Ophryotrocha*. In that work will be found a complete bibliography up to that date.

In the same year Korschelt went into the question, chiefly in reference to the jaws in the Mediterranean species, and arrived at a similar conclusion.

Ehlers (1908) makes no reference to this discussion, but does so in his later memoir, and seems to agree with the conclusions arrived at by Bonnier. Although he retains the title *Paractius notialis* at the head of his account of the worm, he discards it at the end ; for he writes "nach dem allen halte ich es für wahrscheinlich, dass *S. claparedi* und *P. notialis* identisch sind,'' and in all probability are to be assigned to the species *O. puerilis*, which would thus be a highly variable cosmopolitan species.

The only point that remains for solution is the question as to whether Studer's antarctic species is or is not identical with the northern form.

With the abundant material in my possession, I hoped to look into the question more thoroughly, but this Report has already been delayed by the calls on my time for University work, that this matter must for the present remain open. I hope, however, to look into it later, especially to see whether the jaw apparatus presents any constant differences from that of *O. puerilis*.

Locality.—

Boat Harbour.

Distribution.—Kerguelen (Studer, Ehlers), K. Wilhelm-II Land (Ehlers).

Family GLYCERIDÆ.

Genus GLYCERA *Savigny*.

GLYCERA CAPITATA *Oersted*.

Oersted (1843), p. 44, pl. VII, figs. 87, 88, 90–94, 99.
Ehlers (1865–1868), Die Borstenwürmer, p. 648, pl. XXIII, figs. 47, 48.
McIntosh (1885), p. 343.
G. kerguelensis McIntosh (1885), p. 344, pl. XXXV A, figs. 3–4.
G. capitata Ehlers (1897), p. 80.
G. capitata Arwidsson (1898), p. 7, pl. I, figs. 1–6, pl. IV, fig. 54.
G. capitata Ehlers (1901), p. 154 (with synonymy).
Ehlers (1908), p. 105.
Moore (1911), p. 299.
Izuka (1912), p. 249, pl. XXIII, figs. 11–13.
Ehlers (1913), p. 503.
Treadwell (1914), p. 198.

This species is represented in the collection by only two indviduals, both about the same size. The one more carefully studied is imperfect posteriorly, containing 62 segments, measuring 25 mm. in length, with a maximum diameter of 4 mm. some little distance behind the anterior end ; it gradually decreases both forwards to 2 mm. at the buccal segment, and backwards, so that the hinder end of the fragment is 1 mm. It appears, therefore, that only a few segments are missing.

Localities.—
Commonwealth Bay, Station 2, 318 fathoms.
Station 12, 110 fathoms.

Distribution.—Kerguelen (McIntosh) ; Falkland Islands, Magellan Strait, Patagonian coast, Bouvet Island, K. Wilhelm-II Land (Ehlers) ; Azores, Portuguese coast (McIntosh) ; North Atlantic (Oersted); N. Pacific, Californian coast (Moore) ; Alaskan coast (Treadwell) ; Sakhalin Island, Japan (Izuka).

Family SPHÆRODORIDÆ.

Genus SPHÆRODORUM *Levinsen* (nec *Oersted*).

SPHÆRODORUM SPISSUM *sp. nov.**

(Plate 9, figs. 82–89.)

Amongst some material, containing chiefly Syllids, which Dr. Haswell found in sorting out specimens from the Macquarie Island and which he kindly forwarded to me, I find two individuals of this minute worm.

* *spissus*—crowded, close together; as of seats—here, has reference to the integumental papillæ.

One of these had been cleared and mounted in balsam—it measures 4.7 mm., and consists of "head" and 26 chætigerous segments. It had apparently been fixed in osmic acid, for many of the granules in the body wall and in the interior of the body are blackened (fig. 82).

The other, when it reached me in alcohol, was flattened as if it had been studied under a cover slip ; this I stained in alum carmine—its length is 3·5 mm. It is rather difficult to be sure of the number of chætal bundles, for it is flattened asymmetrically, lying on one side with the ventral surface upwards, one series of parapods (of the left side) being along one edge for about half the length, the rest below the margin, the other series lying along the middle of the preparation—they are not easy to see except under a high power.

I believe, however, that there are 25 or 26 pairs of parapods. The body is not otherwise segmented ; there are no external furrows, and internally there are several large ova which are without that regular arrangement they would have were any septa present.

The ventral surface is flat, the dorsal much arched. As the animal lies the distance from one set of parapods to that on the other side is about three times the width of the ventral surface.

The whole surface of the animal is densely covered with crowded papillæ (hence the specific name). These are well seen in profile along the edge, and each is a mass of cellular substance enclosed in a continuation of the cuticle of the body. Over the body the cuticle is unusually thick, but it becomes rather thinner as it rises up to form the wall of the papilla. Within are a few nuclei stained greenish-brown (in the osmic) and some pale carmine-stained protoplasm and threads. At the base the cuticle is pierced by a small aperture allowing a continuity between the contents and the substance of the body wall (fig. 87).

The two ends of the animal are very similar : the anterior end does not present any differentiated prostomium ; no lobe is marked off from the first body segment. At a little distance from the end is a pair of eyes ; at least, so I interpret the structures. In the unstained cleared specimen there is a pair of sharply-defined oval vesicles surrounded by a firm membrane, pale brownish in colour, but without visible contents (fig. 83). In the stained specimen black pigment spots occupy a corresponding position.

I cannot detect any tentacles, although I examined both specimens under high power. There are no processes, other than the papillæ, visible in these flattened specimens, and none of them are longer than their neighbours. The anterior end, like the rest of the body, is densely covered with these papillæ.

There is no distinct peristomium; the first bundle of bristles lies about midway between the eyes and the entrance to the pharynx, which must be a short distance behind the mouth, whose position I am unable to determine. The structure of the head is, in fact, just as Ehlers has described it for *S. parvum*, except that in that species he finds distinct tentacles,

At the hinder end, too, I was unsuccessful in detecting anal cirri—it is merely covered with the papillæ (fig. 84).

On the body generally, so far as it is possible to make out in the flattened condition, the papillæ have the following arrangement:—On the ventral surface there are about five longitudinal rows of papillæ, somewhat smaller than those that cover the dorsal surface. Many of them are tinged with black, as if a secretion had been affected by the osmic acid.

Between the successive parapods are two papillæ in a longitudinal row. Above them the papillæ seem to be arranged roughly in 12–15 rows, judging from the number on the exposed portion of the body—I admit there is room for error here. I have figured a short portion of the body wall at about the middle of the animal (fig. 85). Along the dorso-lateral edge the papillæ are seen lying close together in a row; there are no definite "small" and "large" papillæ, though they are not all quite of the same size (fig. 86). At any rate the definite alternation, such as occurs in *S. parvum* (Ehlers (1913), p. 504) and *S. minutum* (Webster and Benedict) does not exist here.

From the edge I can trace transverse rows to the parapods, some three or four papillæ in each row; these rows are alternately in line with and between the parapods, and are at about equal distance apart; those in the parapodial or mid-segmental row are perhaps a little larger than the others, but the difference is not at all well marked. Also, those in any row that lie nearer to the parapods are slightly smaller than those more dorsally placed. The successive rows tend to alternate with one another in position, though this does not seem absolutely constant, while here and there amongst the others, are a few distinctly smaller papillæ.

The parapods are rather narrow, truncated cones, carrying one, or occasionally two, of the smaller papillæ on the dorsal surface near the base (fig. 86). One of the lips, the anterior I think, is produced into a rounded process, not unlike a papilla, but its contents are not cut off by cuticle from the underlying material.

I cannot see any cirri. Each parapod is supported by a single colourless aciculum, the apex of which just reaches the surface, and carries about six long colourless jointed chætæ, the appendix of which is very thin, scarcely hooked terminally, with a thin blade in which I can detect no striations (in Canada balsam). The appendix is not unlike that figured for *S. parvum*, but is rather shorter (fig. 89).

In the unstained specimen the pharynx is visible, its chitinous lining being outlined by black. It is wrapped round by a coat of muscle, increasing from each end to a considerable thickness in the middle. It occupies the second and third chætigerous segments, *i.e.*, its entrance is behind the first bundle, its hinder end a little in front of the fourth bundle of chætæ (fig. 83).

Around its entrance are some glands, deeply tinted black. The apparatus resembles a "pharynx," such as occurs in various families, rather than a "proventriculus" or "stomach" of the Syllidæ.

I cannot trace any other organs.

The species is manifestly different from *S. parvum* Ehlers, in which the papillæ are fewer, are definitely spaced segmentally in alternating rings of larger and smaller sizes. It differs from *S. minutum* Webster and Benedict, which is densely clothed in papillæ, but they are of two distinct sizes (larger in the parapodial levels, and two or more irregular rows of smaller ones between); (see Southern*). Both these species also have definite tentacles. It may be that in specimens of the new species that have not been flattened they may also be found. However, the parapods and the chætæ are dissimilar.

Family ARICIIDÆ.

Genus Aricia *Savigny.*

Aricia marginata *Ehlers.*

Ehlers (1897), p. 95, pl. VI, figs. 150–156.

Willey (1902), p. 275, pl. XLV, fig. 4 (spine).

Ehlers (1908), p. 116.

Ehlers (1912), p. 23.

Nainereis marginata Fauvel (1916), p. 445, pl. VIII, figs. 26–33 (juvenile form).

This species is characterised by the triserial arrangement of the spines in the anterior 13 or 14 neuropods; by the absence of any fringe or papillæ in their neighbourhood; and by the gills commencing on the sixth chætigerous segment.

The worms before me lack the black lines in the intersegmental furrows and along the margins of the gills, from which the specific name was derived, but it seems now to be recognised that these markings were due to adventitious particles.

Those from the shallower waters of Boat Harbour are white, are coiled, and have a length of about 26 mm. Some of these contain eggs, so that they are not juveniles.

One anterior fragment from 318 fathoms is of stouter build and of a pale brown colour, with an iridescent skin. It measures 20 mm., by 3 mm. across the body and 2 mm. in height. It consists of a head and only 47 segments.

The uncini have the form figured by Willey, with a spoon-shaped hollow near the end, below which are transverse ridges.

Localities.—

Boat Harbour, 2–4 fathoms.

Commonwealth Bay, Station 2, 318 fathoms.

Distribution.—South Georgia, Kerguelen, K. Wilhelm-II Land (Ehlers); Cape Adare (Willey); Roy Cove, Falkland Islands (Fauvel).

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* Southern, *Proc. Roy. Irish Acad. Sci.* 1914, p. 90.

A. MARGINATA *var. nov.* MCLEANI.

(Plate 8, fig. 90.)

This variety differs from the species in having in some of the anterior neuropods an additional partial row of 3, 4, 5, or 6 black spines, starting from below and extending upwards behind the third row. In this respect it recalls the arrangement seen in *A. ohlini* Ehlers (1901), which, however, possesses 10–20 of these spine-bearing segments in place of 13 or 14 in *A. marginata.*

It is true that Ehlers (1913, p. 521), in referring to a form of *Aricia* from the Falklands Islands differing from *A. marginata* in having 17 such segments, expresses the opinion that differences in the number of anterior segments, as well as of gill-less segments, are not of importance in differentiating species in the genus. If this is the case, it is possible that *A. ohlini* is synonymous with *A. marginata,* which agrees in most features with it, though, according to Ehlers, the position of the gill in relation to the parapod is different, for in *A. ohlini* it is closer to the dorsal cirrus, or " lip," than in the other species; and the form of the hinder parapods apparently present certain differences, though the figures given by Gravier (1911, pl. VI, figs. 72–73) for *A. ohlini* are quite different from those given by Ehlers.

For the present it seems better to regard the two species as distinct, though it is clear that they are closely allied, and this new variety emphasises this alliance.

The additional row of spines does not exist on all the neuropods; usually they commence on the 3rd or 4th, and continue to the end of the series. In some cases the third normal row is imperfect at its lower end, but not always, even in the same individual.

The gill commences on the 6th chætigerous segment, though in one individual it is on the 7th, but variation in this respect is already known; and I note, for instance, that in one specimen of *A. marginata* the gill is present on the 5th on one side, and on the 6th on the other.

Some of the specimens are white, others are very pale brown.

The general dimensions and other external features are similar to those in the species.

Locality.—

Commonwealth Bay, 25 fathoms (several).

Genus SCOLOPLOS *Oersted.*

SCOLOPLOS MAWSONI *sp. nov.*

S. kerguelensis Gravier (nec McIntosh) (1911), p. 108, pl. V, figs. 60–63.

(Plate 8, figs. 91-94.)

A vast number of individuals of this small species was collected at Boat Harbour at depths of 2–4½ fathoms. In one bottle there are scores, if not hundreds of specimens.

They are stated to be " red in life," but in the preserved condition, of course, this blood colour is absent; they are almost white, with the anterior end grey. The dimensions are remarkably uniform, and though most of them are curved, the length of the straight ones is 25 mm., with a breadth of 2·5 mm. at a short distance from the anterior end, whence the body tapers slowly backwards. The hinder end is usually imperfect, and many seem to have this region more or less regenerated.

The worm contains from 60–109 segments, the last ten or a dozen of which are very small. Many are sexually mature.

The dorsal surface is flat, the ventral very convex. The prostomium is a short truncated cone; in many cases quite blunt, in others roundly pointed. It is divided from the large peristomium by a furrow, at the anterior margin of which is a pit on each side, and immediately in front of this is a pigment spot. On the ventral surface of this region the large lateral lips are prominent, with a median lip between them.

The anterior eleven segments bear only the low parapods, with lips and bundles of chætæ. The chætæ are colourless, long, extremely fine capilliforms, with a saw-like edge on one side, which is composed of blunt, rounded teeth; the striæ between which do not reach right across the blade.

The dorsal and ventral chætæ are alike, both in the anterior segments and in the posterior. I find no " forked " bristles, nor " acicula," such as Fauvel describes for his specimens of *S. kerguelensis* (1916), p. 443, pl. VIII, figs. 23-24. Each bundle of chætæ issues in front of a more or less pronounced cirrus, or " lip." The lip of the dorsal bundle is conical in form, that of the ventral is lower and of greater vertical height. In the anterior 12-14 segments the chætæ project laterally, but further back the parapods gradually rise up the sides of the body, so that the chætæ become directed upwards. Each segment behind the 14th is triannulate, the middle annulus being much the larger of the three.

The gills commence on the 12th segment, and extend almost to the end of the worm, except apparently on the last 10 segments or so, which are very small, and have no outgrowths of any sort. The gills are sub-cylindrical, somewhat flattened on their antero-posterior faces, which increase in length towards the hinder end of the worm till they are nearly as long as the body height.

In this gilled region the ventral surface of each segment is traversed by a glandular ridge, which commences below the parapod, where it widens out to form a triangular area with the base upwards; in the anterior segments of the branchial region, this dwindles to a small papilla and dies out.

The position of the gills is remarkably constant: thus in 31 individuals of approximately equal size, taken at random, from various vials representing different hauls, I find that in 17 of them the gills commence on the 12th segment on both sides;

in 7 others they are present on the 12th on one side, and on the 11th on the other. Six of them have quite small gills on the 11th segment on both sides. One has a gill on 11th on one side, and on the 13th segment on the other.

Some of the above worms are sexually mature. But in some that are quite young, measuring only 5 mm., I find likewise that in some individuals the gills commence on the 12th on both sides, in others on the 11th, in others again on 11th and 12th. In one specimen of still smaller dimensions there is a very small gill on the 10th segment.

We may, therefore, I think, regard the position of the first gill as being on the 12th segment as a specific character.

The anus is surrounded by a thickened smooth ring, slightly notched dorsally and ventrally; I see no distinct anal cirri in any of the many specimens examined.

Localities.—

Boat Harbour, Commonwealth Bay (collected by Dr. A. L. McLean), 2–4½ fathoms.

Distribution.—Near Port Lockroy (Gravier).

Remarks.—This worm agrees well with that described by Gravier under the name of *S. kerguelensis* McIntosh. At the same time he points out several features in which his worms differ from the account given by McIntosh, and he states "that it is with doubt that I identify with that species the seven small Ariciens obtained from the Roosen Channel, Port Lockroy." The shape of the dorsal and ventral "cirri" (or lips, as I prefer to term them) differs, as also does the shape of the gills, which McIntosh figures as filiform. It may be noted that McIntosh's account and figures are not in absolute agreement as to the position of the gills. Gravier, following Ehlers, suggests that *S. kerguelensis* may be the young of *S. armiger*. His specimens, which were but seven in number, were of small size, about 17 mm., and badly preserved, whereas mine are quite well preserved, and many are sexually mature. And since the gills commence almost constantly on the 12th segment, whereas those in *S. armiger* begin on the 15th-18th, and rarely as far forward as the 10th, it is evident that this surmise is incorrect, at any rate for the species studied by me, and, as I have stated, these agree quite well with those described by Gravier.

Recently, Fauvel (1916) has given a more detailed account of *S. kerguelensis*, and finds some differences from that of the previous authors. But it is clearly different from the present worm, in that the gills appear on the 18th–20th segment; he finds also certain peculiar chætæ—forked, pectinate bristles—commencing on the 10th or 9th segment; these, as I have mentioned, are not present, while on the 10th or 11th segment are one or two acicula, which are likewise absent from these worms.

Again, the ventral "cirrus" in the posterior feet, commencing on the 10th, undergoes reduction till it is a short obtuse "mamelon," which is not true for *S. mawsoni*, where it does not begin to become smaller till at or about the 50th segment.

It seems, then, evident that there are two species of *Scoloplos* in these southern waters. That of McIntosh, Ehlers, and Fauvel on the one hand, and the present species and that described by Gravier on the other. It remains to be seen to which of these should be ascribed those recorded by Willey (1902) under the title of McIntosh's species.

Family CIRRATULIDÆ.

Genus CIRRATULUS *Lamarck.*

CIRRATULUS CIRRATUS *O. F. Muller.*

Müller (1776), p. 214 (not seen.)

C. cirratus Malmgren (1867), p. 95.

Promenia jucunda Kinberg (1865), p. 254.

Promenia fulgida Ehlers (1897), p. 114, pl. VII, figs. 174-176.

Cirratulus cirratus Fauvel (1916), p. 447 (where list of synonyms and bibliography will be found).

Fauvel compared specimens from Falkland Islands, which agree in every feature with Ehlers' *Promenia fulgida*, with the northern form, and was unable to detect any constant differences between them. He therefore arrives at the conclusion tabulated above.

Members of the family are evidently rare in these southern seas, for Gravier reports on only one *Cirratulus* sensu lato (1911), while Ehlers (1913) gives but little information about the few that were collected by the German expedition, leaving most of the fragments unnamed.

The present collection includes a number of specimens from the Boat Harbour, and others from the Macquarie Island, some five or six in each gathering.

Although well known from the Sub-antarctic region, all round the Pole, this is the first time that it has been recorded from the Antarctic Sea.

Localities.—

Boat Harbour, Commonwealth Bay, 2-4 fathoms.

Macquarie Island (low water under stones and in rock pools); collected by Mr. Hamilton.

Distribution.—South Georgia, Kerguelen, Magellan Strait, Fuegia, Falkland Islands; and also Atlantic and Arctic Oceans.

Family TEREBELLIDÆ.

Sub-Family AMPHITRITINÆ.

Genus AMPHITRITE O. F. *Müller*,

AMPHITRITE KERGUELENSIS *McIntosh.*

McIntosh (1876), p. 321.

Grube (1877), p. 546.

McIntosh (1885), p. 443, pl. XLVIII, fig. 7; pl. XLIX, fig. 1.

Ehlers (1897), p. 130; (1901) p. 208; (1908) p. 145; (1913) p. 556.

Gravier (1911), p. 129, pl. XII, fig. 166 (tube).

Five specimens of this large species were obtained at a depth of 157 fathoms, but none are complete. The largest measures 140 mm. for 75 segments, with a diameter of 10 mm. at about the 8th segment. The tube is thick-walled, and consists apparently of fine grey mud; of which a portion measures 40 mm. long, and has a thickness of 5 mm. The mud contains very varied forms of diatoms, both long-shelled and circular; fragments of sponge spicules and a few radiolarian tests. It agrees with Gravier's figure, which he attributes "probably" to this species.

Locality.—

Commonwealth Bay, Station 3, 157 fathoms.

Distribution.—Kerguelen (McIntosh, Grube), Petermann, and S. Shetlands (Gravier), Fuegia and Bouvet Island (Ehlers).

GENUS TEREBELLA (*Linnæus*) *Malmgren.*

TEREBELLA EHLERSI *Gravier.*

Gravier (1906), p. 47, pl. V, figs. 45, 46.

Gravier (1911), p. 130.

Ehlers (1913), p. 556.

In the previous expeditions only one or two individuals of this Antarctic species seem to have been obtained, but during the visit of the "Aurora" to Commonwealth Bay, as many as fifty specimens were procured. It is then evidently fairly abundant in that area, though not nearly so common as some other species of Terebellids. In some instances the label includes a note as to colour, which is "bright red." The worm lives in depths of from 2–6 fathoms, though it seems to be commoner at about 25 fathoms, and less common at greater depths.

There is a slight discrepancy in the account given by the two authors as to the nature of the tube. I find that the membranous basis is covered with material which varies with the nature of the bottom; in some it consists of rather fine sand grains, interspersed with fragments of brown algæ, as described by Gravier. Other tubes

consist of extremely fine grains of grey sand, looking like mud grains. Such tubes have thicker walls than those with coarser grains ; and it is such a tube that Ehlers describes. In both kinds I find echinid spines, and sponge spicules so embedded as to produce a smooth external surface.

One such tube measures 90 mm. long, with a diameter of 15 mm. at its upper end, and its wall is 3 mm. in thickness.

Most of the worms measure from 50-70 mm., with an anterior width of 7 mm., some are larger than this, and one is 90 mm. long. Gravier, however, gives 100 mm. as the length of a specimen with 86 segments.

The number of notopodial bundles varies from 40, 43, 45 and 49 in those examined. Gravier gives 54 and Ehlers 48.

The number of ventral gland shields is 14, 15 and 16, in my specimens. Gravier found 14.

There is no need to add anything to Gravier's account.

Localities.—

Boat Harbour—Among rhizoids of floating brown Algæ (Dr. McLean).
Boat Harbour, 2–4 fathoms. Station B, 25 fathoms.

Commonwealth Bay—
Station C, 15–20 fathoms.
Station D, 45–50 fathoms.
Station E, 55–60 fathoms.

Distribution.—South American Antarctic (Gravier), Kaiser Wilhelm II Land (Ehlers).

Terebella vayssieri *Gravier.*

Phyzelia vayssieri Gravier (1911), p. 130, pl. X, figs. 121–123; pl. XI, figs 134, 135.

The tube of this species, of which several were gathered, consists of variously coloured sand grains, loosely and irregularly arranged to form a thick wall not unlike that of some tubes of *T. ehlersi.*

The worms attain a length of 40 mm., with a diameter of 6 mm. anteriorly, at about the 8th segment ; the body begins to contract at about the 15th segment to 4 mm., which diameter is retained for some distance, and then it begins to taper.

There is one point upon which I lay stress in identifying the worm, and that is the form of the uncinus in the anterior segments ; the great length of the basal process, which starts below the teeth of the uncinus, seems to be characteristic.

There are indeed one or two points in which my specimens seem to differ from Gravier's account, which may be due to differences in the state of preservation or of age. Thus, he states that he could detect no eyes. In most of the present worms these are distinctly present as a series of minute black dots, in two to four rows on each side: this oculiferous area occupies about half the height of the prostomium on each side. In some of my specimens, however, they are absent. And it has been noted by Ehlers and other authors that in some species of Terebellids eyespots are sometimes present, sometimes absent.

I think that Gravier must have overlooked the fact that the ventral surface of 2nd and 3rd segments coalesce, though they are distinct laterally and dorsally, and laterally the 2nd segment is very much compressed, and therefore quite short. He states that the "flap" is borne by the 2nd segment. I find it distinctly on the next. Also the first gill is said to be on the first segment, instead of, as I find it, on the 2nd.

Again, Gravier writes that "there is only one row of uncini." This is true for the anterior and posterior segments, but from about the 10th to the end of the thorax, that is to segment 18, I find that there are two series of uncini close together and facing alternately fore and aft, interdigitating with each other, so that they simulate a single row till examined under a microscope.

The bristles of the 1st notopod have simple points, with a narrow flange on both sides, which is not striated. But the bristles of the later segments are stouter, with a narrow flange on one side and a broader one on the other, each faintly striated.

Apart from these slight discrepancies I think there is no doubt that the worms before me are identical with those described by my French colleague.

Locality.—

Boat Harbour, $3\frac{1}{2}$–4 fathoms.

Distribution.—Off Terre Alexandre and Port Cironcision (île Petermann).

Remarks.—Both Ehlers and Gravier, in discussing the allied form *T.* (*Phyzelia*) *fasciata* Grube, show how difficult it is to define the genera and sub-genera of this family; they give up in despair the attempt to set things right for these exotic species, although De St. Joseph has arrived at some apparently satisfactory conclusions with regard to the European species.

In dealing with this species Gravier expresses himself as being unable to decide whether it should come into the genus *Polymnia* Mlmgrn, or *Nicolea* or *Scione*, and yet finally he places it in *Phyzelia*, which has received different limitations by various authors. Under the circumstances it may be as well left in the genus *Terebella* lato sensu.

Genus Scione *Malmgren.**

Scione mirabilis *McIntosh.*

Pista mirabilis McIntosh (1885), p. 454, pl. LI, figs. 1, 2; pl. XXVII A, fig. 34.
An unnamed tube, McIntosh (1885), Introduction, p. 10, pl. XLIX, figs. 8, 9.
Scione spinifera Ehlers (1908), p. 152, pl. XX, figs. 10–14.
Scione spinifera Gravier (1911), p. 134, pl. XII, fig. 156 (tube).
Scione spinifera Ehlers (1913), p. 561, pl. XLIV, fig. 7 (tube).
Scione mirabilis Ehlers (1913), p. 562.

(Plate 9, figs. 97–100.)

The material consists of seven individuals, two of which were still within their tubes, the rest having been removed therefrom before preservation.

The tube is nearly straight with the upper free end bent downwards as figured by previous authors. One tube measures 150 mm. along the curve, the other attains a length of 240 mm.; the lower end is lacking in both, but a greater portion is absent from the longer one. The tube has a cylindrical lumen, 5 mm. in diameter; the external surface is raised into four longitudinal ridges which bear the characteristic long spine-like processes; these are from 10–12 mm. in length in the upper region and decrease gradually towards the lower end to 1 mm., while in the lowest quarter they are absent.

In the upper part, for a distance of about 10–20 mm., the ridges die out and the spines depart from their regular linear arrangement, becoming scattered over the surface. This region is of looser texture than the lower part, there being less mud adhering to the basal membrane, and consequently, too, the wall is translucent.

Embedded in the mud wall are bundles of sponge spicules, such as McIntosh describes for *Pista* (*Scione*) *mirabilis*; they are disposed circularly and closely parallel to one another. They are present also in the " spines," where they are disposed lengthwise. On the surface of the tube wall and on the spines are various colonies of Polyzoa, Hydrozoa, and a portion of what seems to be *Rhabdopleura*, which is unfortunately poorly preserved and the polypides are either absent or indistinct.

The complete worm removed from the smaller of the two tubes has a body length of 50 mm. for 92 segments; its breadth anteriorly is 4 mm. thence tapering to the hinder end. Most of the tentacles are lacking, and the few that remain are broken.

The largest specimen in the collection had already been removed from its tube before preservation; it is about 70 mm. in body length, to which 20 mm. is to be added for the length of the tentacles; its diameter is 7 mm., and the body contains about 90 segments. This specimen is twisted in the abdominal region and is somewhat soft further forwards, so that these dimensions are not absolutely correct. These specimens are smaller than the individual of *S. spinifera* measured by Ehlers.

* *Scione* is another preoccupied name, according to Leiper.

The anatomy agrees with the account of *S. spinifera* given by Ehlers; but as his drawings of the animal are not very clear in certain points, I add a couple of somewhat diagrammatically constructed figures in order to show the morphological relations of the "lateral flaps," &c. (figs. 97, 98).

In 1913 Ehlers hesitatingly suggested that possibly the two species, *S. spinifera* Ehlers and *Scione (Pista) mirabilis* McIntosh, are identical, for in writing of the specimen of *S. mirabilis* from Kaiser Wilhelm II Land, he remarks (p. 562) :—

> "Nicht völlig gehobene Zweifel bestehen darüber, ob die Würmer nicht identisch mit der von mir im vorstehenden erwähnten *S. spinifera* Ehl. sind."

He then goes on to discuss the few differences which are, as he terms them, "insignificant," and I may add comments on the four points to which he pays attention.

> (1) "The differences in the structure of the tube may be due to differences in the nature of the sea-bottom, and other conditions of the habitat."

The characteristic feature of the tube both of *S. spinifera* and *S. mirabilis* is the presence of long, slender, flexible processes or "spines" which project from its surface and may be longer than the diameter of the tube.

In McIntosh's species the tube is cylindrical and the spines appear to be scattered all over the surface without any regular arrangement, but in the original account of *S. spinifera* Ehlers states that they are arranged in longitudinal rows. The tube figured by Gravier (pl. XII, fig. 156) as *S. spinifera* is likewise cylindrical with processes irregularly disposed. But more usually in those worms attributed to Ehlers's species they arise from definite ridges which extend almost throughout the length of the tube, and these ridges give it a very characteristic appearance, which was first figured by McIntosh (though without a name) and later by Ehlers under the title *S. spinifera*. He and McIntosh found three such ridges, but in the present collection each of the two tubes which I received has four ridges. I find that at about the region at which the tube curves over at its upper end these ridges die out and the spines lose their linear arrangement and extend irregularly over the surface. Ehlers (1913) notes, too, that the ridges die out at the lower end in his species, though this is not the case with those before me.

The material of which the tube is composed is a thin leathery membrane with fine particles of mud worked up with the secretion. These mud grains are arranged in a very regular fashion, as described and figured by McIntosh for his unnamed tube; they are disposed in narrow circles round the circumference, each circle overlapping the next below. In *S. mirabilis* McIntosh observed sponge spicules embedded in the mud, closely arranged parallel to one another, around the tube; and similar spicules contribute to the support of the processes or spines where they are arranged lengthwise. These spicules were also found by Ehlers in his specimen of *S. mirabilis* (1913), but he did not find them in the tube of *S. spinifera*.

In the two tubes, however, from Commonwealth Bay, which agree in externals with the latter species, these sponge spicules are present, and their arrangement agrees precisely with that described by McIntosh. There is thus a parallel series of form and of detail in structure in the tubes of the two " species."

Ehlers, when comparing the two " species," points out that he had no information as to whether his specimen of *S. mirabilis* was obtained in the same haul as his *S. spinifera*, *i.e.*, whether they occurred close together, though they came from the same locality; nor had he any information as to the nature of the sea-bottom which would explain the difference observable in the structure of the tubes.

But McIntosh found that the base of some of the tubes of *S. mirabilis* were embedded in sponges, which would account partly for the small proportion of mud in his tube-wall and wholly for the presence of sponge spicules.

A comparison of the sea-bottom at the localities at which the various specimens of *S. spinifera* have been obtained does not give sufficient information, I think, to account for the presence or absence of the spicules.

The " Challenger " *S. mirabilis* were got on a bottom of " greensand," the " Valdivia " *S. spinifera* from bottoms of " blue mud," of " volcanic sand " and of " mud," and Ehlers states that the tubes were covered with black and grey mud. The " Challenger " *S. spinifera* tubes were obtained from " blue mud."

In this recent expedition the tubes came from a bottom of " granitic rock, no ooze." No mention is made as to whether sponges were found at this station, though it is quite possible that this was the case. If so, that would account for the spicules in the wall of the tubes. Gravier does not mention whether he examined the tubes for spicules, presumably he did not, since they are not mentioned in the original account of that species.

(2) " The stem of the gill in *S. mirabilis* in McIntosh's figure is longer than in *S. spinifera*."

But in the specimens from Commonwealth Bay which had been removed from the tube before being preserved, I find that the stem is very short, broad and wrinkled (fig. 97), and gives off two approximately equal branches ; it is almost exactly like Ehlers' figure of *S. spinifera*. On the other hand, in a specimen which I extracted from its tube, within which it had been preserved, the gills are bent backward ; the stem is long (fig. 98), as figured by McIntosh for his species. The difference, then, between the length of the stem of the gill, as observed by the previous authors, seems to be a matter of greater or less contraction.

In the latter individual its position, flattened against the body and fully extended, allows a careful study of its structure to be made. The stem divides into two unequal branches, one of which seems to be a continuation of the stem, the other external to it; each gives off other branches of varying lengths, which bear the terminal filaments. Figure 98 is a careful drawing of the extended gill.

There is one point on which Ehlers makes no comment, and that is the fact that McIntosh states that the stem divides into three and that each of these splits into several branches, whereas in *S. spinifera*, as figured in 1908, there are only two main branches. Perhaps it is a matter of small importance, but it may as well be referred to here. In one of my specimens one of the two branches divides again soon after its origin, giving the impression of three divisions. McIntosh's figure shows at least five branches, which I think is an error on the part of the artist.

> (3) " Judging from McIntosh's figure of the animal, a segment appears to be intercalated between the two segments which bear the lateral ' flaps ' or lobes, and his account is difficult to correlate with the figure."

Ehlers, in describing his specimen of *S. mirabilis*, finds no such intercalated segment; the gill is on the 2nd segment, the lateral lobes on the 3rd and 4th as in *S. spinifera*; the shape of the first flap is similar in the two forms, and is larger than the second flap.

I have introduced a figure showing more diagrammatically than does Ehlers's figures the real arrangement of these segments. I have little doubt that McIntosh's figure is misleading.

> (4) Ehlers has noted certain differences in the form of the uncinus as described and figured by McIntosh for *S. mirabilis*, and those he himself describes for *S. spinifera*, in regard to the smaller denticles above the large fang. McIntosh describes three denticles, but his figure (pl. XXVII A, fig. 34) shows at least four and perhaps a minute fifth. Ehlers in his specimen of *S. mirabilis* finds a single tooth between the fang and the cap of small denticles, so that the uncinus appears to be three-toothed when seen from the side. In *S. spinifera*, according to Ehlers, this intermediate tooth is absent.

In the specimens from Commonwealth Bay, I find a difference from both these accounts, or rather from all three, for instead of there being only one intermediate tooth I find three rows of small teeth, of 2, 3 and 4, or sometimes of 3, 4 and 4 respectively, between the fang and the cap of minute denticles (fig. 100). In a side view (fig. 99) the uncinus is more like the figure of one of " the anterior hooks " given by McIntosh than to the figure illustrating Ehlers's account.

Some further points of comparison may be made.

The dimensions of the worms have perhaps little value in deciding their identity, yet they may be included in this analysis. Ehlers's type of *S. spinifera* was imperfect ; but in 1913 he gives the dimensions of a complete individual.

	Body length.	Diameter.	Number of segments.
Ehlers	105	6	134
Gravier	75	—	91
" Aurora "	70	7	90
S. mirabilis McIntosh ...	58	2	—

Dimensions of tubes—*S. mirabilis,* McIntosh, 150-160 mm. by 4 mm.; *S. spinifera,* Ehlers, Gravier and myself, 150-240 mm. by 5 mm.

Geographically and bathymetrically, the two "species" overlap. Both were obtained from Kaiser Wilhelm II Land; and *S. spinifera* extends up the west coast of South America to Valparaiso (McIntosh), while *S. mirabilis* occurs up the east coast as far North as Rio de la Plata (McIntosh).

The depth at which the two forms have been obtained varies from 110 fathoms ("Aurora") to 2534·7 fathoms ("Valdivia"). These have the "spinifera" form of tube, while the *S. mirabilis* form comes from 212 fathoms (Ehlers) to 600 fathoms (McIntosh).

It is then evident that Ehlers was fully justified in his expression of doubt as to the distinctness of the two species, and it must of course retain the name bestowed upon it by McIntosh.

Locality.—

Commonwealth Bay—

Station 2,318 fathoms (two).

,, 8,120 fathoms (four, the one studied is a male).

,, 12,110 fathoms (a female distended with eggs).

Distribution.—Off Valparaiso, off Rio de la Plata (McIntosh), south of Bouvet Island, Kaiser Wilhelm II Land (Ehlers), Graham's Land (Gravier).

Genus LEÆNA *Malmgren.*

LEÆNA ARENILEGA *Ehlers.*

Ehlers (1913), p. 564, pl. XLIV, figs. 8–13.

(Plate 9, figs. 95, 96.)

Two specimens only were obtained during this expedition, which is in contrast with the abundance of the worm off Kaiser Wilhelm II Land.

The present specimens show some apparent differences in the structure of th "head" from that described by Ehlers, but whether these are due to differences of preservation, or of interpretation, or of state of development, or are specific, it is difficult to decide when so few individuals are available. But since the worms agree in all essential features with his account I attribute them to his species, but add figures to illustrate the apparent discrepancies.

The tube is long and narrow, measuring 100 mm. in length by 3 mm. in width. It is built up of a single layer of transparent, colourless sand-grains with a slight admixture of other material, such as sponge spicules; the outer surface is rough, and the grains seem very loosely adherent. It is more or less undulating, as if it had been coiled amongst other objects.

The contained worm measures only 40 mm., exclusive of the tentacles, which add another 10–12 mm. to the length. It is nearly cylindrical, tapering only slightly posteriorly.

The body contains about 70 segments ; the intersegmental grooves, however, are very indistinct posteriorly, so that there may be more.

The tentacular platform (fig. 95) is low, and the post-tentacular region bears an irregularly double row of eye spots laterally, but this becomes a single row across the dorsum ; the right and left rows are continuous, whereas Ehlers found a short dorsal gap separating the two groups.

The first segment is very short on the dorsal surface, but becomes swollen and enlarged laterally (figs. 95, 96), projecting forward here. This glandular thickening extends almost to the mid-line on the ventral surface, but the right and left lobes become narrower as they approach one another and terminate in rounded lobes, separated by a very narrow, short, non-glandular area.

It is here that I find a difference from Ehlers' account. He represents a large oval, forwardly-directed " flap " of much greater extent, and this, instead of tapering off towards the mid-ventral line, is here almost as long as it is higher up the sides, and the two lobes overlap.

The second segment is likewise short on the dorsal surface, but is swollen so as to form a transverse ridge, which crosses the dorsum and extends down each side as far as the margin of the first gland shield. It is quite a definite structure ; but in Ehlers' figure it seems to be confluent with the flap of the first segment. Possibly these structures are not at their full development in the specimens before me.

The first notopod is borne on the third segment, and the uncini commence on the fourth. On each of the segments 5, 6, and 7 there is, above the notopod, near the hinder margin of the segment, a low but distinct nephridial papilla.

There are 16–17 bundles of bristles, but there are only ten well-developed notopodial outgrowths.

The uncinigerous neuropods are short throughout the worm, and lateral in position. Anteriorly, as in the 15th segment, there are 19 uncini, but further back the number is reduced to 6 or 7. The uncini agree precisely with the description given by Ehlers, and differ from those of *L. abranchiata* Malmgren and from *L. wandelensis* Gravier.

The ventral gland shields number 11, and are quadrate in form, except the first four, which are narrower transverse glandular bands.

Locality.—

Commonwealth Bay, 15 fathoms (with *T. ehlersi* and *Th. antarcticus*).

Distribution.—Kaiser Wilhelm II Land.

Genus Thelepus *Leuckart.*

Thelepus setosus *Quatrefages.*

Phenacia setosa Quatrefages (1865), vol. II, p. 376.

Neottis spectabilis Verrill (1875).

Neottis antarctica McIntosh (1876), p. 321; (1879), p. 261, pl. XV, figs. 14, 15; (1885), p. 472, pl. LII, fig. 1.

Thelepus mcintoshi Grube (1877), p. 544.

Thelepus spectabilis Ehlers (1897), p. 133, and his later works.

Thelepus spectabilis Gravier (1906), p. 53.

Thelepus setosus Fauvel (1916), p. 466 (for full list of synonyms).

This Terebellid, which, as will be seen, has already been described from the subantarctic under a variety of names, has now been identified by Fauvel with the European species. He had under his eyes specimens from the Falkland Islands and examples from the Straits of Dover, and arrives at the conclusion—"le *Thelepus spectabilis* de l'hemisphère sud ne peut être en rien differencié du *Thelepus setosus* de la Manche."

I can now add another locality, extending its range to Macquarie Island. Some of these, which were well preserved, were from Garden Bay, others from the North End; some were found attached to rocks below low water, others were from sand under stones at low water.

Distribution.—Strait of Dover, coast of Ireland; Kerguelen (Grube, McIntosh); Bouvet Island, Marion Island (McIntosh); Fuegia, South Chili (Ehlers); Port Charcot, Ile Booth Wandel (Gravier); Falkland Islands (Pratt, Fauvel); S.W. Australia (Fauvel (1917), p. 268).

Thelepus antarcticus *Kinberg.*

Kinberg (1866), p. 345.

Willey (1902), p. 278, pl. XLV, fig. 6.

Ehlers (1901), p. 210 (repeats Kinberg's record).

The brief diagnosis given by Kinberg is scarcely sufficient to enable one to visualise the species, but the few facts he does give agree with those exhibited by the specimens in this collection, and I have no doubt that they belong to that species which has hitherto been recorded, since 1866, only by Willey.

In view of the enormous numbers that were obtained by the expedition (in one jar there are more than one hundred individuals), it is very remarkable that none of the recent expeditions to the Southern seas has met with it.

It is very similar to the Northern *Thelepus cincinnatus* Fabricius, as Willey has pointed out, with which indeed he suggested that it is conspecific. But there appear to be a few differences from that Northern form, which has recently been described at length by McIntosh (1915, p. 26).

Under the circumstances, it seems worth while to give the essential facts about the worm.

The animal grows to a large size, frequently attaining a body length of 140 mm. or even more (in one specimen it reaches 190 mm.). To this length of body must be added that of the tentacles, which measure some 30–40 mm., though of course they are much coiled and contracted, so that in life they must exceed this measurement.

The number of segments is 90–100 ; the diameter of the worm first mentioned is 7·5 mm.

The sides of the body are thick, rough, brownish, and very glandular ; and this is continuous with the large ventral gland shields.

The cephalic collar or platform which bears the tentacles, carries numerous eye-spots over its entire extent.

There are two bunches of gill filaments on each side of segments 2 and 3, which latter is also the first chætigerous segment. Each bunch consists of a single transverse row of simple unbranched filaments—about 15 in a row on each side in the first gill—leaving a small gap in the median dorsal line equal to about the width of three filaments. The anterior gill extends downwards to below the level of the notopod. The second gill is smaller, and consists of some twelve filaments, and the dorsal gap is slightly wider.

In twenty-five individuals, taken at random out of a jar containing more than one hundred, every one had two pairs of gills. Not one of all those examined showed any variation in this respect, which seems to justify the use of the genus *Thelepus* for two-gilled forms, or at any rate to refute the idea that variation in this matter commonly occurs in a species.

The first notopod occurs on the third segment and is repeated on every segment throughout the worm, though in the hinder ones the number of chætæ becomes much fewer (in *T. cincinnatus*, McIntosh states that the notopod is absent in the last forty segments). The first neuropod lies in the 5th segment. It is of considerable extent, reaching down to the margin of the gland shield. But after the 10th segment it begins to dwindle in height and at the same time to project outwards, so that by the 20th segment the neuropod has quite a short vertical extent not more than twice that of the notopod, and so remains throughout the greater part of the animal, as oar-like appendages.

The margin of the anterior neuropods is darkly pigmented. The chætæ of the first notopod and of those that follow are of two kinds, as in *T. setosus*,

The uncini are uniserial, small, closely-set, and numerous, there being at least sixty in one of the posterior lobes. When seen from the side the uncinus presents two teeth above the great fang, one large and one small, as McIntosh (1915, p. 29) states for *T. cincinnatus*, there is but a "single tooth," "though occasionally a minute third tooth is visible." I find that when viewed from above the fang is crowned by a row of three teeth usually of approximately equal size, and a single minute tooth placed eccentrically outside this series; sometimes two of these minute teeth occur.

The gland shields number 10–13, they are not at all distinctly defined, being rough and traversed by furrows. In *T. cincinnatus* McIntosh gives 30 shields. I looked carefully into this, and found not more than 13 in any specimen.

The tube, as usual, is membranous, covered with sand-grains of very varied sizes; in some cases they are so coarse as to deserve the name "pebbles," so that the outer surface is extremely rough and uneven; in others, the grains are finer and more uniform in size and the surface much smoother. Mixed with the sand-grains are fragments of brown or green algæ, and occasionally portions of Echinid tests.

Localities.—

Boat Harbour, 25–30 fathoms.

Commonwealth Bay, Station C, 15–20 fathoms (very abundant; bottom rock, with small amount of brown algæ).

Distribution.—York Bay, Bucket Island, Magellan Strait (Kinberg); Cape Adare, S. Victoria Land (Willey).

Remarks.—According to De St. Joseph, "*Thelepus*" may have one, two, or three pairs of gills. McIntosh says of "*Neottis*" that it differs from *Thelepus* in having three gills, whereas Malmgren's diagnosis defines *Thelepus* as having two pairs only. Willey, and I agree with him, points out the confusion that ensues from the wider use of the word; but modern writers continue to use it in this extended sense. It is evident that this large common antarctic form is common off Adelie Land, and differs from *T. setosus*.

Fauvel has identified *T. spectabilis* with *T. setosus* Quatrefages, and in a later paper (1917, p. 269), accepting Willey's suggestion that Kinberg's species is conspecific with the Northern *T. cincinnatus*, goes even further, and, relying on the possibility that in the same species the gills may vary from two to three pairs, puts forward the view that the latter may be identical with *T. setosus*: "Mais ceci n'est encore qu'une simple hypothèse."

The fact that in dozens of this Southern form, whether it be *T. cincinnatus* or not, there is no sign of any such variation shows that this "hypothèse" is still unproven, and that for the present the two species, *T. setosus* and *T. antarcticus* (or *T. cincinnatus*), are distinct.

Genus LEPREA *Malmgren.*

LEPREA STREPTOCHAETA *Ehlers.*

Ehlers (1897), p. 130, pl. VIII, figs. 203–205.
Ehlers (1913), p. 560.
Fauvel (1916), p. 465.

A single individual of this species was received from Macquarie Island, where it lives in rock pools.

It was still invested in its sandy tube, and the animal, which is somewhat coiled, as both Ehlers and Fauvel found to be the case, measures about 45 mm. with an anterior breadth of 3 mm., tapering posteriorly.

I have nothing to add to the full accounts already published.

Distribution.—Kerguelen, Falkland Islands, Uschuaia.

Genus POLYCIRRUS *Grube.*

POLYCIRRUS HAMILTONI *sp. nov.*

(Plate 9, figs. 101–106.)

A number of well-preserved worms, enclosed in tubes of dark sand-grains, were found by Mr. Hamilton attached to rocks at low water on the Macquarie Island. They are described as being "pink in colour."

The worms are for the most part a good deal twisted, some are broken, but amongst them a few that are complete.

A complete specimen measures from 25–35 mm. in length, with a breadth of 2 mm. One mature female, filled with eggs, has a length of 25 mm. and contains 55 segments ; another of 35 mm. has 50 segments.

The numerous tentacles are of considerable length.

There are 30–34 bristle-bearing segments, which commence on the 2nd. The uncinigerous neuropods commence in one case on the 7th, in another on the 11th chætigerous segment.

There are 13 pairs of gland shields preceded by a median shield on the first or peristomial segment (fig. 101). This gland is pentagonal in shape with its lateral angles somewhat rounded ; it is crossed by a curved shallow furrow from side to side. Then follow the series of paired glands separated by a narrow but deep groove mesially. The first of these, which lies on the first chætigerous segment, is subtriangular, with its anterior side fitting against the latero-posterior border of the pentagonal gland and its apex directed mesially. The remainder are more or less quadrate. These are followed by three widely separated pairs of smaller size.

Below each of the first eight notopods is a small nephridial papilla, lying just outside the gland shields.

The notopods commence on the second segment and are repeated along the greater part of the worm, *i.e.*, for 30–34 segments; they are rather prominent, with the posterior lip produced beyond the anterior (fig. 102). The chætæ are of two kinds—(*a*) those of the usual type with an symmetrical apex, a flange on one side, the sloping margin being finely striated (fig. 103); and (*b*) more slender, symmetrical and without a flange, but with very fine denticulations along each edge (fig. 104). There are about ten of each kind in the anterior notopods, but posteriorly the number of each becomes fewer, and the slender form (*b*) may be absent.

The neuropods commence below the 12th or 13th notopod; the uncini are uniserial; each has a short manubrium or base, and bears two teeth (fig. 105) with a thin curved undivided hood above them (fig. 106). Behind the teeth there is a small projection from the base as usual, but I cannot, in spite of careful search, detect any knob springing from the base in front of the teeth, such as Gravier figures for *P. insignis*; not even so much of a hump as McIntosh figures for *Ereutho kerguelensis*.

Locality.—

Macquarie Island, Garden Bay.

Remarks.—This worm does not agree with any that have been described from the Antarctic or Subantarctic seas. It bears some resemblance to *P. insignis* Gravier (1906, p. 54), in which, however, the first notopod is on the fourth segment and there are 11 notopods only, so that it should be placed in the genus *Ereutho*, if we follow Malmgren; but Gravier accepts De St. Joseph's views on this matter.

Genus EREUTHO *Malmgren.*

EREUTHO ANTARCTICA *Willey.*

Willey (1902), p. 281, pl. XLII, fig. 6; pl. XLVI, fig. 6.

Polycirrus kerguelensis McIntosh (1885), p. 475, pl. XXVIII A, fig. 22.

Polycirrus kerguelensis Gravier (1911), p. 141, pl. XI, fig. 136.

nec. *Ereutho kerguelensis* Ehlers (1913), p. 365.

In the "Challenger" Report McIntosh describes two species of Polycirrids from Kerguelen, namely *Ereutho kerguelensis* (p. 474), and on the next page, *Polycirrus kerguelensis*. The latter was an ill-preserved fragment, and no details about its structure are given except that the uncinus is characterised by a very long manubrium, and bears two stout short teeth.

Willey, in his report on the "Southern Cross" annelids gives a brief account of a Polycirrid from S. Victoria Land which exhibits precisely similar uncini, but the

worm has but 11 chætigerous segments bearing notopodial chætæ, followed by the uncinigerous segments; and therefore falls into Malmgren's genus *Ereutho.* He named it *Ereutho antarctica.*

Consequently, if reliance be placed wholly on the form of the uncinus, which certainly is quite peculiar, McIntosh's *Polycirrus kerguelensis* is in all probability this Ereutho; but he had already given the specific name " kerguelensis " to an Ereutho which has quite a different form of uncinus. Hence a new specific name is needed, and we must adopt Willey's name " antarctica."

Gravier (1911) describes, under the title " Polycirrus kerguelensis McInt.," a worm which has 11 chætigerous and 25 uncinigerous segments, whose uncini agree precisely with the figures of McIntosh and Willey, and he remarks (p. 143) that it is extremely probable that it is identical with Willey's species.

Later, Ehlers (1913), under the title " *Ereutho kerguelensis* McIntosh " (which he regards as synonymous with Willey's *E. antarctica*), describes a worm with uncini agreeing with that figured for *Ereutho kerguelensis* (not *Polycirris kerguelensis*) of McIntosh, but differing from that figured by Willey for his species.

Ehlers states that the only difference between the two is that McIntosh records 13 chætigerous segments, while Willey gives the number as 11. Ehlers himself finds both 11 and 12; and as the number of notopodial segments is variable, he concludes that the two species are identical. But this leaves aside altogether the marked difference between the uncini in the two cases.

Ehlers refers to the conspicuous anterior lip of the anterior notopods produced into a " papilliform process " (McIntosh), but neither author figures it. I do not see any such striking feature in the present worms; the lips are nearly of a size.

The present collection contains specimens of this species, without their tubes. The worms are for the most part coiled, and measure about 12–15 mm. with a diameter of 3 mm. anteriorly.

There are 11 segments bearing notopods with capillary chætæ, followed by 25–30 segments carrying short projecting uncinigerous neuropods. The first notopod is on the third segment above the first pair of ventral gland shields.

A mounted piece of the thoracic pre-uncinigerous region shows none of the peculiar hooks below the capilliform chætæ such as Ehlers describes in his *Ereutho kerguelensis.*

The present worms agree generally with the account given by Gravier.

Locality.—

Boat Harbour, $3\frac{1}{2}$ fathoms.

Distribution.—Kerguelen (McIntosh), South Victoria Land (Willey), Petermann, and South Shetlands (Gravier).

Family AMPHARETIDÆ.

Genus Phyllocomus *Grube.**

Phyllocomus dibranchiata *sp. nov.*

(Plate 10, figs. 107–123.)

A worm which was dredged from a depth of 157 fathoms, seems to form the type of a new species of this rare genus.

It is distinctly differentiated into thorax and abdomen, the former bearing both notopodial chætæ and uncinigerous neuropods, the latter presenting only the neuropods, which project laterally like wings or oars.

The specimen (fig. 107) is very well preserved, and appears to be strongly contracted anteriorly ; it is a pale yellowish colour, while the parapods and glands are pale brownish and the ventral surface of the abdomen rather darker.

It is fortunately complete, though the hinder end appears to be regenerated, as no uncini can be detected on the last ten segments.

Its total length is 45 mm., with a width of 11 mm. anteriorly and a height of 8 mm. The body tapers backwards slowly, so that at the commencement of the abdomen it measures 6 mm. in width.

The worm contains 60 segments, with head and anal funnel, which is surrounded by a number of short cirri (fig. 115). There are 15 notopods with long pale yellow chætæ; 14 of these thoracic segments are glandular across the whole ventral surface, though distinct gland shields are not evident. The anterior glands spread from the neuropods of one side to those of the other, which are here separated by a space of 8 mm. The last three or four are traversed by a definite furrow in the middle line. There are indications of two additional glands behind these.

The head (figs. 108, 109) is very obliquely truncated, so that its anterior face is nearly vertical; the prostomium has the form of a sub-circular plate sloping downwards from the dorsal surface of the body, nearly at right angles to the body axis; the lower extremity of this plate is free, and its edge is thin. This prostomial plate is of firm consistency, almost chitinoid; it is tinted in the middle with reddish brown pigment, is slightly convex from side to side in its middle, and slightly concave from its front backwards, so that its free rounded edge projects horizontally.

On each side, between the prostomial plate and the curved peristomial ridge, is a narrow elongated depression from which a slight papilliform elevation rises. Grube suggests that this is a secretory organ; perhaps, however, it represents the ciliated

*" Phyllocomus " looks like a masculine word and appears to refer to the "foliaceous" form of the gill ; but Grube uses the feminine "crocea" for the species. I therefore consulted my Classical colleague, Professor Adams, who informs me that there is a rare Greek word "komos" meaning a "bundle or sheaf," which is feminine : presumably Grube used this rare word.

nuchal organ of many Polychaeta. Just anterior to this, but only visible from the ventral surface, is a little patch of pigment a short distance from the anterior margin of the prostomial plate; this probably represents an eye-spot (fig. 113).

The prostomial plate is continuous dorsally and laterally with a curved semicircular ridge, from which it is separated by a shallow furrow, but this ridge is also continued downwards across the ventral surface to form the lower lip, which is closely pressed against the upper lip formed by the prostomial plate, the anterior edge of which it does not reach (fig. 109).

Whether one is to regard this curved ridge as the hinder region of the prostomium, such as is described for several Ampharetids, or as the peristomium, seems uncertain; but from its relations I take the latter view.

The ventral region of this peristomium is produced forwards in the middle line, so that a median and two lateral regions of the lower lip are distinctly marked off from one another (fig. 113); the median lobe has a straight transverse edge which is abruptly limited on each side by a nearly longitudinal margin, that turns sharply outwards to form the anterior edge of the lateral region of the lip. When the animal is seen from above, this lower lip is invisible, since it is overhung by the prostomial plate, and even when viewed from below, its base is partly concealed by the forward extension of the ventral surface of the following segment.

The branchiferous segment, the second of the body, is very much compressed on its dorsal portion, so as to form an upstanding fold; its ventral portion is thick and glandular and conceals in great part the lower lip.

On the dorsal surface this segment is rather longer than the peristomium, and carries a pair of admedian, upstanding gills of unusual form and structure (fig. 109). Each gill is 4 mm. in height, *i.e.*, about half the height of the body at this point; it consists of a rather thick axis, which bears along its whole length four undulating tough membranes, two on the external and two along its internal or medial surface. The membranes are broad below and taper distally so that the form of each gill may be described as quadrifoliaceous and lanceolate, in Grube's terms.

The two gills are connected at their bases by a low transverse membraneous ridge (perhaps exaggerated by the contraction of the body), which is continued outwards and downwards almost to the level of the notopods of the following segments.

Passing backwards and outwards from this ridge, commencing behind each gill, is a deep channel, bounded by a couple of narrow walls which, about midway in their course towards the base of the third notopod, unite above the channel and convert it into a tunnel. This tunnel appears to end blindly (fig. 110).

Two quite similar but successively shorter structures pass from the branchiferous ridge towards the second and first notopod, above which they respectively terminate.

These structures appear to be the "areolæ" of Grube's account of *Phyllocomus crocea* (1877, p. 543), and the relative disposition of them seems to correspond to the three structures figured by McIntosh (1885), pl. XLVII, fig. 11), which he interprets as the bases of lost "gills."

These three pairs of channels and tunnels appear to be unique, and I regret that, having only a single specimen of the worm, I am unable to examine them by sections. I have no suggestion to make as to their purpose. The worm is well preserved, and there is no evidence of rupture here, no suggestion that any structure, such as a gill, has been broken away; the margins of the channels are rounded and smooth, and appear quite natural. At any rate, under the highest power of a dissecting microscope I can see no sign of any interruption in the continuity of the surface.

The tentacles, as is usually the case in the family, are invaginated into the buccal cavity. They were exposed by slitting up the side of the body along a line corresponding to the junction of the lower lip with the peristomium (fig. 113). Then numerous filamentous tentacles are seen directed backwards along the roof of a cavity, which I suppose is the buccal cavity; they are borne by a rounded ridge, which extends across the base of the prostomium, curving forwards on each side till nearly in the line of the lateral margin of the lower lip (fig. 116).

Within the lower lip, along its base, is a second rounded ridge which connects right and left with the tentacular ridge; it is apparently a sphincter muscle, and may be exaggerated by the contracted state of the worm.

The tentacles are 10 mm. in length and are united to one another for a distance of about 3 mm. from their origin, where they are only indicated by lines separated by shallow furrows. The proximal portion of the tentacles is surrounded by a thin membranous flap, 1 mm. in height, springing from the tentacular ridge; and when the tentacles are lifted up a line of brown-red pigment-dots is seen close to its free margin on its tentacular surface; further, a second line of darker spots lies along its base, close to the roots of the tentacles (fig. 117).

The body.—The dorsal surface is smooth, annulate and without inter-segmental furrows, but the segments are distinct enough laterally and ventrally; the body is very strongly arched, so that the notopods are directed upwards; the third segment, like the next two, is much narrower than the following, though whether this is again due to the strong contraction of the worm seems doubtful, in light of the statement by Grube that in his species these three segments are shorter than the rest.

The third segment carries the first notopod, which is smaller than the following, and bears only a few chætæ. The next two notopods are likewise small, but the number of chætæ increases; the maximum is attained at about the sixth or seventh, and this is retained until the fourteenth.

The bristles are long, stout and of a golden-yellow colour; they are arranged in a single vertical series with longer ones above and successively smaller ones below.

Microscopical study of them, under varying conditions and from different aspects, reveals a new type of bristle; new not only to this family but, as I think, new to the class.

Some time previously I had made a drawing of one of the chaetæ from a group separated out and freshly mounted in glycerine; it was symmetrical, finely pointed with a narrow flange on each side, and very similar to that figured by Fauvel (1897) for *Ampharete grubei* (pl. XVII, fig. 24.) But amongst them I found others in which the bristle is curved and has only one rather broader flange. I supposed therefore that there were two kinds of chaetæ in the bundle.

Some months later, when preparing this account for publication, I had occasion to refer to my preparations, one of which was in Canada Balsam. I was surprised to see that all the chætæ are alike, curved, with a single flange. Wishing to ascertain how I could have been deceived in my earlier examination, I cut off a fresh parapod, separated out the chætæ and made a new mount in glycerine.

Again I saw in most of the chætæ two narrow flanges. I then pressed the coverslip so that the chætæ might be flattened out a little; now all of them had a single flange. I then lifted the coverslip, turned the chætæ about and re-examined them. Again I saw several with the two flanges.

A careful study under a high power informed me that the chæta really has three flanges, two narrow ones lying in one plane, symmetrically arranged, and a third broader one in a plane at right angles to them; and in this position the chæta is curved. Having made this discovery, it was easy to detect the three flanges in some of the chætæ, and I have drawn one of them (figs. 118–120).

To what extent this observation may shed light on discrepancies in the accounts of chætæ in some families, *e.g.*, the Terebellidæ, I cannot say. It is evident that a renewed study of the bristles in certain families is desirable.

The ventral surface of the thorax is nearly flat, and traversed by a wide shallow median furrow, which increases in depth posteriorly, and after the last gland shield becomes very deep but narrower; the margin of the furrow is formed by the rounded muscular ridge on each side.

The uncinigerous neuropods commence below the 4th notopod. Those on the anterior segments of the thorax are vertical ridges, limited to the sides of the body, and originating near the hinder boundary of the segments; their edges rise only slightly above the surface. In the hinder segments each neuropod becomes more prominent, thick and fleshy, while in the abdomen they are narrower and become flap-like (fig. 114). The neuropod is now a quadrangular flap directed backwards and outwards; its free edge carries the uncini. On its upper surface near the body wall is a small rounded papilliform upgrowth (which is, perhaps, a dorsal cirrus). By the 12th abdominal the neuropods are already much longer and project still further; the dorsal

"cirrus" has increased in size, and has become sub-cylindrical; the distal upper angle of the foot becomes produced into a distal cirriform process (? the "lip" of the chætophore), in addition to the dorsal "cirrus" (fig. 121).

The neuropods decrease in size posteriorly, and the inferior angle becomes more marked.

The general form of the neuropod is similar to that occurring in other Ampharetids, but the presence of both the proximal "papilla" and the distal "supra-uncinal process" seems unusual. The proximal papilla, which I have termed "cirrus," is usually regarded as equivalent to a vestigial notopod; and the distal process to the dorsal cirrus (cf. Fauvel (1897), Ehlers (1887) p. 220).

The uncinus has five teeth in a single series, and a small prominence between the smallest of these and the rounded upcurved extremity of the plate (figs. 122, 123); it is quite similar to that figured for *P. crocea* by McIntosh (1885), pl. xxvi a, fig. 25).

The structure of the gill (figs. 111, 112). Although the condition of preservation is not sufficiently good to allow a thorough study of the gill to be made, the examination of a short series of transverse sections enables me to give an account of its more striking features.

The gill axis is traversed by a canal, whose wall is composed chiefly of muscle. Externally there is a layer of tall columnar cells bearing a thick cuticle; within this is a thin circular coat of muscle, which envelopes a thicker coat of longitudinally arranged muscle fibres. This does not seem to be limited very definitely internally, for there is a layer of loose connective tissue, in which are scattered irregularly a number of small round nuclei. At places in the series of sections I believe that I can detect the remains of a thin membrane forming the lining of the axial cavity; but the tissue is here broken and imperfectly preserved, and it may even be that the canal is an artifact, and that the axis is occupied by a core of loose connective tissue.

Running along the wall of the axis at two opposite points is a blood vessel, lying apparently in the longitudinal muscle coat, but in places it projects into the cavity.

The folia or gill membranes are, of course, cut transversely; the central part consists of connective tissue, enveloped in the epidermis. I can see no cilia, though perhaps this is due to the state of preservation. A series of blood vessels is cut across, lying close to one another along each side, underneath the epidermis. They give to the section a very characteristic appearance, and seem to be connected across the folium; but I was unable to trace out precisely how or where they communicate with the axial blood vessels.

Locality.—

Commonwealth Bay, Station 3, 157 fathoms.

Remarks.—That the genus *Phyllocomus* is rare is evident from the fact that although it was established by Grube as long ago as 1877 for the species

P. crocea, it has only been recorded since that date in the "Challenger" report. Grube's material appears to have been but a single specimen, which was obtained between Heard Island and the Crozets. That collected by the "Challenger" came from Kerguelen.

I regard the present as a different species since Grube describes two pairs of gills in some detail, and he makes no mention of the four membranes springing from the axis; he describes the gill as foliaceous "quasi lanceolata." McIntosh gives a brief account of a mutilated anterior end of a worm which he ascribes to Grube's species. His figure (pl. XLVII, fig. 11), agrees in general form quite closely with the worm herein described, but is without any gills. In the text he writes (p. 427), "the next segment bears dorsally the marks of four branchial processes on each side."

His figure shows three pairs of pit-like structures, which are no doubt the "channels" that I describe above, and which I suppose Grube refers to as "areolæ." McIntosh seems, however, to interpret them as the bases of gills. They have the same relation to one another and the same position on the segments as I have described. It may be very likely that he had before him the present species.

As both these accounts are brief, and as only one figure of this interesting genus has been published, it has seemed to me worth while to give rather a detailed description of the worm.

Genus AMYTHAS, *gen. nov.**

AMYTHAS MEMBRANIFERA, *sp. nov.*

(Plate 10, figs. 124–132.)

A single individual of this remarkable worm was obtained from a depth of 325 fathoms in Commonwealth Bay.

It is imperfect posteriorly, lacking, however, only a few segments, and consists of a head and thirty segments, measuring 60 mm. in length, with an anterior diameter of 12 mm., which diameter decreases posteriorly till at the end of the fragment it is only 5 mm. The anterior region is a good deal contracted, and the animal was ruptured about half-way along its length, and broke into two pieces on being handled.

As in other genera, the body is divisible into two regions, thoracic and abdominal; the former is indicated by the seventeen pairs of notopods with capilliform chætæ, which are absent in the abdomen. The thoracic region appears to be strongly contracted, so that probably the dimensions of the worm just given are not quite correct. The whole

* The name is formed by transferring the initial "S" of *Samytha* to the end.

dorsal surface is very convex, and the segmentation is obscured by numerous closely set annulations. The ventral surface of the thorax is highly glandular, but no definite "gland shields" are delimited, as the glandular modification of the integument extends across the ventral surface from right to left unicinigerous nueropods; but on the last three segments the outlines of the glands are evident.

In the abdomen the ventral surface is deeply concave, crossed, however, by segmental rounded, transverse ridges.

The prostomium (figs. 124, 125) consists of two portions, viz—(*a*) an anterior freely projecting flap overhanging the mouth; and (*b*) a posterior thickened transverse fold, which is almost entirely hidden by the basal portion of the second or branchiferous segment.

The prostomial flap, or upper lip, is slightly trilobed, the middle lobe being more prominent than the later regions, from which it is marked off by a slight notch on each side. The middle lobe is inclined forwards and upwards, and has a somewhat thickened free edge. On raising the prostomial flap, or on looking into the mouth from in front (fig. 127), the base of the prostomium is seen to be continuous, with a transverse lobulated structure, or "supra-oral arch," which is separated from it by a furrow. The right and left extremities of this arch touch the upper part of the lower lip on either side; the median portion of it is smooth, and traversed by a number of fine furrows radiating from its base forwards towards its edge; the lateral portions are thick and swollen.

The buccal segment or peristomium is represented dorsally by a rounded transverse ridge, overlapped and concealed by the branchiferous segment. Ventrally, however, it is produced forwards to form a great lower lip, which is separated from the lateral region of the prostomial flap by a deep, horizontal cleft on each side, and it is evidently very mobile (fig. 126).

Between the upper and lower lips there projects a folded membrane (fig. 127), which occupies the entire oral cavity. At first I supposed this to be a part of the gut everted, but found on dissection that it has the following relations, from which it is clear that it represents the series of tentacles of other Ampharetids. The free edge of this "tentacular membrane" is thickened in the median region, but becomes thinner towards each side. It is folded much in the way that a partially closed fan is folded, but the folds are few and irregular. It arises from the under surface and posterior margin of the "supra-oral arch" above mentioned (fig. 128), which is thus seen to correspond to the tentacle-bearing ridge of other genera. The line of origin of the tentacles is at about the level of the junction of the arch with the prostomial flap. At this point—as was seen by slitting open the body wall—the buccal cavity (or œsophagus?) commences; this is a tube with a thick, muscular wall, whose inner surface is thrown into a number of rugæ. Its floor is produced forwards to form an internal lip, such as that figured by Fauvel (1897) for *Amphareté grubei*.

This tentacular membrane, then, has the same topographical relations as the bundle of filamentous tentacles in other genera of the family, and it is unfortunate that, having only this single individual, I am unable to study its structure as fully as it deserves.

Following the peristomium is the branchiferous segment (figs. 124, 125, 126). Its dorsal surface is raised up as a transverse fold, which overhangs the peristomium and the posterior portion of the prostomium. It is continued downwards as an ordinary segment, but is without chætæ. This segment carries three pairs of gills, which arise in a transverse line; they are long, simple, sub-cylindrical, and grooved along the posterior margin. The base is more or less expanded, and each terminates on a bluntly rounded extremity. Of the six gills, however, only two remain entire: on the right side the most dorsal, which is 15 mm. long, and on the left side the middle gill, which is 10 mm. long; the other four are represented by more or less of their basal region.

The two most dorsal gills are close together near the middle line; the base of each is produced outwards as a rounded ridge, passing obliquely outwards across the dorsum to end at the base of the second notopod. The second gill is immediately external to the first, and the third lies just above and in front of the first notopod.

There are seventeen pairs of notopods, rather prominent lobes, carrying very long, stout, brown bristles; the first notopod is on the third segment, which is much compressed between its neighbours (this is perhaps due in part to the contraction of the body); it is smaller than the rest, and carries fewer and shorter bristles; the second is longer, the following increase in size, and the full development of the foot is attained at the sixth or seventh.

The bristles, of which there is a considerable number in each notopod, arranged in a double or triple vertical series, are brownish in colour; each is long, thick at the base, slightly curved, and produced into a very fine point; there is single flange on the convex border.*

The uncinigerous neuropods commence below the fourth notopod on the sixth body segment; they are definite, wing-like, mobile organs, increasing in prominence posteriorly. In the thorax the neuropod has a long, vertical, uncinigerous margin, equalling in height that of the organ itself, but in the abdomen the neuropod is very convex superiorly, and has a short uncinigerous margin directed somewhat downwards (fig. 129).

The uncini are uniserial throughout the body, and number about eighty in the anterior feet.

The uncinus (figs. 130, 131) has two rows of four nearly equal teeth, springing from a short, broad base, which is produced into a rounded lobe beyond the fourth

*Treated as I treated the chætæ of *Phyllocomus* I find that the two lateral flanges are not present.

tooth, which is slightly smaller than the others; the base has also a small lobe on its lower edge below the first tooth. The uncini are similar throughout, but on the thorax are larger than on the abdomen.

Locality.—

Commonwealth Bay, Station 10, 325 fathoms.

Remarks.—The worm agrees fairly well with Malmgren's diagnosis of *Samytha*, from which it differs in three noticeable features—(1) the form of the prostomium; (2) the presence of a folded membrane in place of filamentous tentacles; and (3) the form of the uncinus. It bears no resemblance to the only known Antarctic Ampharetid *Samytha* (?) *speculatrix* Ehlers (1913, p. 554). Consequently, a new genus is necessary, which may be defined as follows:—" Ampharetids with a trilobed prostominal flap; tentacles represented by an invaginable membrane; three pairs of cylindrical gills on the second segment; seventeen pairs of notopods; uncinus with four paired sub-equal teeth on a broad base.

Family CAPITELLIDÆ.

Genus ISOMASTUS *Gravier*.

ISOMASTUS PERARMATUS *Gravier*.

Gravier (1911), p. 113, pl. VIII, figs. 88–93; pl. IX, figs. 94–108.

Four specimens of this, the only *Capitellid* known from the antarctic, were gathered, amongst which a well preserved male measures 42 mm. in length by 2 mm. in diameter anteriorly; it contains fifty-two segments following the head. There is also a female in the collection.

Locality.—

Boat Harbour, Commonwealth Bay, 3½ fathoms (muddy bottom).

Distribution.—Admiralty Bay, South Shetlands, Petermann (Gravier).

Family MALDANIDÆ.

Genus RHODINE *Malmgren*.

RHODINE INTERMEDIA *Arwidsson*.

Ardwidsson (1911), p. 11, pl. I, figs. 5–11; pl. II, figs. 39–41.

R. loveni Willey (1902), p. 276, pl. XLVI, figs. 3–5.

R. antarctica Gravier (1906), p. 39, pl. IV, figs. 33–37.

R. loveni Gravier (1911), p. 125, pl. IX, figs. 110–112; pl. X, fig. 114; pl. XI, fig. 133.

A single imperfect specimen, consisting of the head, followed by thirteen chætigerous segments, and another portion consisting of six posterior segments, measure in all 35 mm. by 1 mm. in diameter.

Previous authors have noted the readiness with which the hinder segments break away, owing to the extremely slender connections between them, so that the true dimensions of the species is unknown.

It is almost colourless, except that in front of the chætæ of each of the segments 4–10 is a pinkish area occupying more than half the length of the segment. This is the "anterior glandular band" of Arwidsson, with which the indistinct "posterior band" is continuous. There is no need for me to add anything to Arwidsson's exhaustive study of the species.

Locality.—

Commonwealth Bay, Boat Harbour, $3\frac{1}{2}$ fathoms.

Distribution.—Cape Adare, Victoria Land (Willey); Port Charcot and Petermann (Gravier); South Georgia (Arwidsson).

Remarks.—It is thus circumpolar.

Genus ISOCIRRUS *Arwidsson.*

ISOCIRRUS YUNGI *Gravier.*

Gravier (1911), p. 122, pl. IX., fig. 109; pl. X, figs. 115–120.

Gravier's type specimens were two fragments, of which one was an anterior portion and the other a short piece of the hinder end. They are a good deal smaller than the specimens collected by the "Aurora," and the tube in which the animal lived was not collected or reported upon.

Eleven individuals of the species, mostly imperfect, were obtained at a depth of 157 fathoms. In most of them the body is encircled by a portion of the mud-tube, which has a very thick wall; thus a worm measuring 7 mm. in diameter fills the lumen of a tube whose external diameter is 11 mm., so that its thickness is 2 mm.

A complete individual studied is 110 mm. in length with a breadth of 5 mm. anteriorly. Another one, lacking only the anal funnel and a portion of the long preanal segment, attains a length of 135 mm. with a breadth of 7 mm.; but judging from some of the fragments still within their tubes, the species may reach even a greater size than this.

The colour is almost uniform pale brown, except that in one or two cases the 5th and 6th segments are darker than the rest; the glandular band at the commencement of the segments is nearly white.

The complete individual first mentioned above consists of the "head," followed by nineteen elongated chætigerous segments and a long preanal segment; this bears six glandular half-rings, corresponding in position to the uncinal glands to be described

below, and so probably represents six segments; of these glands the three anterior extend further round the body than do the other three. The body terminates as usual in an anal funnel.

The uncini commence on the 5th segment, and the neuropods of the last seven segments are very prominent.

In the 2nd, 3rd, and 4th segments there are one or two short, stout, bluntly-pointed spines below the small bundle of capilliform chætæ : Gravier in speaking of these says that there is " une rangée de crochets ventraux "; if by this he means a vertical row of hooks the statement does not apply to these specimens.

The " head," *i.e.*, the prostomium and peristomium, is equal in length to the 2nd segment ; each of the next five segments is approximately equal to this; but each of the following six is a good deal longer. But it depends on the state of preservation, for in some extended worms this difference between the first five and the next six is hardly noticeable. The chætæ in this genus are inserted near the anterior boundary of the segment; in the first five, at about one-third ; in the following six or more, at about one-fourth the length of the segment.

There is a glandular band surrounding the prechætal region of each segment, this is interrupted on each side by a deep, narrow, horizontal furrow. This glandular band forms, in some individuals, a feeble collar, but in extended specimens the overlap is not apparent. At the segment on which the true hooks appear, namely, the 5th, there is also a post-chætal gland; at first this is narrow, but as the series of uncini becomes longer this gland increases in width as well as in length. By the 8th segment the pre-chætal band is differentiated into a narrow dorsal and a wider ventral portion; and the ventral gland, which now appears as a large oval patch, overlaps the previous segment more distinctly. By the 10th the dorsal gland has become considerably reduced, and on the 11th has disappeared, so that posteriorly only the ventral or uncinal gland persists; this enlarges in the segment further back, till in the 17th, for instance, it covers half its length.

I have given these details as Gravier says nothing about them; the arrangement is entirely in agreement with the general character of the glands described by Arwidsson for the genus.

Gravier's account of the prostomium, or cephalic plate, needs no addition, though his figure is somewhat diagrammatic. The dorsal transverse portion of the membrane that surrounds the plate is crenated. He states that there is a dozen low rounded lobes, but I find that the number and form is variable. Sometimes they are uniform in size, though in some individuals they may be larger than in others; in the former case I counted 18 lobes, in the latter as many as 25. In other individuals, the smaller and larger lobes are irregularly alternating.

The anal funnel, as the generic name implies, is surrounded by uniform digitations, of which I count as many as 36.

A figure of the capilliform chætæ is given by Gravier; but his interpretation of the hook is not quite in agreement with what I see. The large fang is surmounted by four others of much smaller size; and there are some laterally situated small teeth at the base of the large fang. Further, the bay between the fang and the bundle of threads is deeper and roughly semicircular in outline.

It may be that these small differences depend on the segment or region of the worm from which the uncinus is taken.

Locality.—

Station 3, 157 fathoms.

Distribution.—Petermann.

Family ARENICOLIDÆ.

Genus ARENICOLA *Cuvier.*

ARENICOLA ASSIMILIS, *var.* AFFINIS *Ashworth.*

Ashworth (1903), p. 760, pls. XXXVI, XXXVII.

Ashworth (1912), p. 123, pl. VII, fig. 16; pl. X, fig. 29; pl. XIII, fig. 45; pl. XIV, fig. 50 (a full bibliography herein).

Fauvel (1916), p. 455.

Twenty specimens, carefully preserved in formaline, were collected by Mr. Hamilton at Macquarie Island, where they are common, embedded in sand and broken shells, between rocks, two inches below the surface at low tide.

They vary in length from 40–140 mm. The colour in life is stated to be for most of them "pale green with red gills." These have turned brown in the preservative; others were "dark green" in life, and have become almost black.

Locality.—

Garden Bay, Macquarie Island.

Distribution.—New Zealand, Magellan Strait (Ehlers); Falkland Islands (Ashworth, Fauvel); North Tasmania, Table Bay, S. Africa (Ashworth); Campbell Islands (Benham).

Family CHLORHÆMIDÆ.

Genus FLABELLIGERA *Sars.*

FLABELLIGERA MUNDATA *Gravier.*

Gravier (1906), p. 37, pl. IV, figs. 31, 32.

Gravier (1911), p. 110, pl. VIII, fig. 87.

Ehlers (1912), p. 25.

Ehlers (1913), p. 535, pl. XLI, figs. 1–12.

Of the three specimens in the collection, the largest measures 93 mm. in length; its greatest breadth is 18 mm., its height 10 mm. It is thus larger than that described by Ehlers.

The 26 bundles of capilliform chætæ project for 16–25 mm. beyond the translucent, firm, jelly-like investment of the body, which is here greyish, not yellowish-brown as described by the previous authors. The chætæ, which are covered with mud, are accompanied by long-stalked clavate papillæ.

Localities.—

Station 10, 325 fathoms (one).

Station 12, 110 fathoms (two)

Distribution.—Port Charcot, South Shetlands (Gravier); Kaiser Wilhelm II Land, South Victoria Land (Ehlers).

Family SABELLIDÆ.

POTAMILLA *Malmgren.*

POTAMILLA ANTARCTICA *Kinberg.*

Laonome antarctica Kinberg (1866), p. 354.

Laonome antarctica Ehlers (1897), p. 135 ; (1901), p. 216.

Potamilla antarctica Gravier (1906), p. 59, text-figs. 38–43.

Potamilla antarctica Gravier (1911), p. 144, pl. XI, figs. 137–141.

Potamilla antarctica Ehlers (1913), p. 575.

Potamilla antarctica Fauvel (1916), p. 474, pl. VIII, figs. 4–7.

Of this species, so widely and abundantly distributed through the antarctic seas, a large number were forwarded to me. They may be grouped for convenience of reference into two lots; partly from their geographical range, and partly from the size of the individuals.

Group A consists of small individuals from 25–40 mm. in length, exclusive of the gills. These occur on the shores of Macquarie Island. They agree in dimensions, as well as in external features, with the worms described by Ehlers, Gravier,* and Fauvel, which has hitherto been regarded as the typical condition of the species.

Group B contains much larger worms, attaining lengths ranging from 72 mm. up to 230 mm., exclusive of the gills. These come from Commonwealth Bay, at various depths; and the larger ones exceed in size the largest specimen, of which the dimensions have hitherto been recorded, namely, that mentioned by Ehlers as being 170 mm. in length, obtained from South Victoria Land.

From their much greater dimensions I expected that these would prove to belong to a different species, but after examining them from every anatomical point of view, I came to the conclusion that there are no features that distinguish them from the more typical specimens under Group A, other than their size.

* Gravier describes the species as if it were new, affixing his own name after it.

We must therefore regard them as older, perhaps much older, stages of development than the smaller ones.

I will deal with the two groups separately.

Group A.—The Macquarie Island Form.

Masses of densely aggregated, small, brown, horny tubes set side by side horizontally, with the free ends curving away from the main axis, were obtained from rock scrapings, and from the under-side of stones at low water, at the North end of the Island. The free end of the tube is thinner and has sand grains adherent to it.

The contained worm, removed from one such tube, has a total length of 35 mm., of which the gill-plume occupies about 5.6 mm.; the body is 2.5 mm. in width, and contains 65 segments.

The gills are speckled with red-brown dots and splashes, closely set along the inner side of the filaments, the shaft being unpigmented. The filaments are loose and curl outwards; I find 15–20 filaments on each side. There is no inter-filamentary membrane.

Eggs were attached to the gills, as has been stated by other writers. The thorax in these small forms contains usually 8 segments; though sometimes only 7.

Group B.—Commonwealth Bay Forms.

Of these I have seventy-two specimens, some still within their tubes, others have been removed therefrom before preservation.

The tubes are of tough parchment-like material of a yellow-brown colour; but those from greater depths, 110–120 fathoms, are more darkly coloured, and are rather olive-brown.

The longest tube measured came from 25 fathoms; it attains a length of 400 mm. with a diameter of 8 mm.; the surface is smooth, the upper end thinner, flexible, and paler in tint. It has some sand grains adherent to it.

Another tube from the same haul is much paler in tint, and much slenderer than the majority; measures 90 mm. by 1.5 mm.

Still another tube is 270 mm. long, and contains a worm measuring 226 mm. inclusive of the gills, which account for 44 mm.

A worm of 150 mm. exclusive of the gills, which are 40 mm. long, contains 190 segments. Its breadth at the collar is 6 mm.; its greatest breadth is 8 mm., and the height of the body 5 mm.

I measured a number of these worms from various depths in order to see whether there was any correlation between size and depth, but I find none.

The thoracic region presents a much wider range of variation as to the number of component segments than do those in Group A. Of those examined I find the following numbers :—

Six have 8 segments.

One has 9.

Three have 10.

Three have 11.

Five have 12.

Three have 12 on the right side and 13 on left.

One has 14.

Two have 15.

One has 14 on the right side and 10 on the left.

There is no apparent relation between the length of body and that of thorax, for in three worms measuring 170 mm. two have 8 thoracic segments, and one has 12.

Eight segments occur, also, in a worm 135 mm. long; 11 segments occur in a worm 195 mm., while another of the same length has 14 segments.

In two smaller worms of this group, measuring 72 and 85 mm., I find that the thorax contains only 8 segments. It seems, then, in a very general way that the number of thoracic segments increases with the size, that is the age, of the individual.

The gills contain a much larger number of filaments than in the typical form of the species. Thus, there are thirty to forty filaments on each side; but in a worm 170 mm. long, I find only twenty-one filaments.

The pigmentation of the gills is liable to much variation also. In some they are uniform in tint, or rather uncoloured; in others there are the usual irregularly arranged splashes of red-brown along their length. In one case I noted that some of the dorsal filaments are without pigment, though most of them have a band of brown extending from the tip to about quarter the length; or even further down in the more ventral filaments. A few of them have in addit on a short transverse band about half-way down.

In another individual there are three fairly regularly disposed patches at quarter, half, and three-quarter of the length from the base upwards, while the apex is, as usual, uncoloured.

Others, again, have more numerous distinct bands up to eight in number. One of the smaller specimens has purplish pigment arranged in irregular dots at wide intervals apart along the filaments.

Probably, had one only a few of these larger worms before one, a new species would have been warranted, but I prefer to leave these in the present species.

Localities.—

Macquarie Island.

Commonwealth Bay, Boat Harbour—

Station B, 25 fathoms (forty).

Station 3, 157 fathoms (three).

Station 7, 60 fathoms (eight).

Station 8, 120 fathoms (nine).

Station 12, 110 fathoms (seven).

Distribution.—Magellan Strait (Kinberg); Fuegia, Uschuaia, South Georgia, Kaiser Wilhelm II Land, Kerguelen, South Victoria Land (Ehlers); Ile Booth Wandel (Gravier); Falklands Islands (Fauvel).

Remarks.—It is more than probable that the worm referred to as *Sabella ceratodaula* Schmarda by Miss E. Pratt (1900) as occuring at the Falklands is this species.

Family SERPULIDÆ.

Genus Serpula *Linnaeus, s.st. Philippi.*

Serpula vermicularis, *var.* narconensis *Baird.*

S. narconensis Baird (1864), Proc. Linn. Soc., London, vol. viii, p. 21, pl. II, figs. 7, 8 (operculum).

S. narconensis McIntosh (1885), p. 516, pl. LIV, fig. 5; pl. LV, fig. 1; pl. XXXI A, fig. 23.

S. narconensis var. *magellanica*, McIntosh (1885), p. 518, pl. LV, fig. 2; pl. XXXI A, figs. 24, 25.

S. patagonica Grube (1877), p. 550.

S. vermicularis Ehlers (1897), p. 140; (1901), p. 219.

S. vermicularis var. *narconensis* Ehlers (1912), p. 31; (1913), p. 581.

S. vermicularis Gravier (1906), p. 62; (1911), p. 147, pl. XII, figs. 170–174.

Baird established his species on a single specimen obtained during the Ross Antarctic Expedition; it was without a tube, and was characterised by its operculum. McIntosh (1876, p. 322) compared it with a specimen collected by the Venus Transit Expedition to Kerguelen, which, although it lacked the operculum, was in its tube. He satisfied himself that the two are identical.

In 1897 Ehlers placed Baird's species as a synonym for *S. vermicularis*, and suggested that McIntosh's var. *margellanica* should be included. But in 1912 Ehlers makes it a distinct variety, the tubes of which, he showed, are linked on with the type by a number of intermediate forms, in some of which even the everted lip, upon the possession of which Baird founded his species, was lacking.

Several of these characteristic tubes, some containing the animal, were obtained during the expedition of the "Aurora."

The narrow, white calcareous tubes have a diameter of 2·75 mm., and the thickened everted lip is 4·5 mm. across. Along the course of the tube are similar thickened lips at intervals, indicating periods of cessation of growth. The tubes are more or less undulating, or may be coiled, where they are attached to some object, such as a stone or shell.

Localities.—

Boat Harbour, Station B, 25 fathoms.

Commonwealth Bay—

Station 1, 354 fathoms.

Station 2, 318 fathoms.

Station 3, 120 fathoms.

Station 9, 240 fathoms.

Station 10, 325 fathoms.

Distribution.—"Ile Narcon in the Antarctic Ocean" (Baird), Kerguelen (Grube), Marion Island, Heard Island (McIntosh), Magellan Strait (McIntosh, Ehlers), Admiralty Sound, S. Victoria Land, K. Wilhelm II Land (Ehlers), South American Antarctic (Gravier).

Genus SPIRORBIS *Daudin.*

SPIRORBIS NORDENSKJÖLDI *Ehlers.*

Ehlers (1901), p. 223.

Ehlers (1908), p. 165.

Gravier (1911), p. 153, pl. XI, figs. 153, 154.

Gravier has pointed out that it is difficult to be certain as to the identification of this species, as Ehlers has given no figure of it. Hence it is with some hesitation that I attribute our specimens to this species; they agree with the accounts referred to above and with Gravier's figures.

Localities.—

Boat Harbour, 3–4 fathoms.

Commonwealth Bay, Station D, 45–50 fathoms.

Distribution.—Punta Delgada, Bouvet Island (Ehlers), Petermann (Gravier).

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EXPLANATION OF PLATES.

Plate 5.

Syllis closterobranchia (figs. 1–2).

Fig. 1. A parapod, anterior face ($\times$ 45).

2. The ends of two acicula.

S. brachycola (fig. 3).

Fig. 3. Tip of aciculum.

Sphærosyllis mcintoshi (figs. 4–6).

Fig. 4. Anterior end, dorsal view ($\times$ 45). Camera outline from a specimen mounted in glycerine.

5. Ventral view of the same ($\times$ 45).

6. The tips of acicula.

Autolytus charcoti (figs. 7–10).

Fig. 7. A transverse section of the body, atokous stage, in front of the middle (camera $\times$ 30). The dorsal cirri present a series of glands along the upper part of the outer surface; the great ventral glandular pad is distinctly marked off from the body.

8. A chæta from the upper part of a bundle ($\times$ 720).

9. The "head" of Polybostrichus, ventral view (camera $\times$ 20), showing the relative lengths of the appendages and the ventral swellings below the great lateral tentacles.

10. The "head" of Polybostrichus, dorsal view ($\times$ 30), showing the epaulettes of the species; some of the appendages cut short.

Exogone anomalochæta (figs. 11–13).

Fig. 11. Anterior end, camera outline ($\times$ 90); the nuchal organ is seen on the left side.

12. Hind end ($\times$ 90).

13. The three forms of chætæ in the dorsal bundle (enlarged: (*a*) Tip of the capilliform; (*b*) end of the uppermost gomphotrich, side and fiont views; (*c*) one of the remainder of the bundle, both aspects.

Hololepidella flynni (figs. 14–20).

Fig. 14. Dorsal view of the head ($\times$ 10); the palp and peristomial cirri of the right side are omitted. On the left side the first elytrophore is indicated.

15. A parapod of a cirriferous segment, posterior face (camera $\times$ 15).

Fig. 16. A parapod from an elytriferous segment anterior face (× 15).

17. One of the ventral chætæ (× 90).

18. A ventral chæta from about the middle of the bundle (× 90).

19. The apex of a ventral chæta (× 260). The pectinated frills are very delicate and have an irregular course.

20. The apex of a dorsal chæta (× 250).

PLATE 6.

Harmothoe spinosa (fig. 21).

Fig. 21. Dorsal view of a portion of a specimen, showing a "chess-board" pattern. The parallel lines represent olive; the groups of dots, brown; where these are closer together, a dark brown. (Enlarged.)

Harmothoe tuberosa (figs. 22–29).

Fig. 22. Tip of a dorsal chæta (× 360), showing the characteristic "bearded" nature of the upper frills, as seen in an unworn chæta. The hairs really lie more closely alongside the axis, but are here represented as outspread so as better to show their relations. The hairs from the lower bundles in the figure have been omitted from the near surface. The apparent "spines" are the edges of the frills composed of the bases of several hairs superposed.

23. Side view of the apex of a dorsal chæta from which the "hairs" have been worn away (× 360). The aspect as seen in Canada balsam mounts is likely to be misleading, as owing to the transparency of the frills in front of the axis, the structure is scarcely visible; but in glycerine mounts it is more readily interpreted; the apparent spines along the edge are then seen to be the frills bending round the bristle, and are thus a measure of the height and thickness of these frills.

24. Portion of the shaft of the same dorsal chæta, immediately below the apex shown in fig. 23 (× 360). This shows the angular character of the shaft and the difference in the nature of the frills on face and side. The uppermost frills are confined to the front face, the lateral frills commence some distance from the apex.

25. A ventral chæta from about the middle of the bundle (× 35).

26. A ventral chæta from upper part of the bundle, the frilled region from the side, showing the spines in the upper frills (× 360).

27. The same from the front face (× 360), showing two rows of spines one on each side.

28. Three posterior elytra of an individual with abnormally developed conical tubercles (× 6).

29. The last elytron of the same (× 10).

Harmothoe abyssorum (figs. 30–35).

Fig. 30. View of the head (× 10).

31. Front view of the prostomium, showing the tips of the "peaks" and the relative position of insertion of the median and lateral tentacles.
32. A cirriferous parapod (camera, × 10).
33. A tubercle of an elytron, side and top views (enlarged).
34. A dorsal chæta (× 90).
35. A ventral chæta (× 90).

Eulagisca corrientis (figs. 36–38).

Fig. 36. The head dorsal view (× 5). The tentacles are broken off, the palps are represented as having been cut away to a greater or less amount, and the subtentacular frontal cone (*f.c.*) is seen below and projecting beyond the tentaculophore. The peristomial parapod is produced into a fine point (*l*) between the dorsal and ventral cirri.

37. View of the head from in front (× 5), showing the position of the frontal cone. The three tentacles are seen to lie in the same plane. The peristomium is foreshortened, and only the apex of the lobe (*l*) and insertion of the two cirri are indicated; (*l*) elytrophore of second segment.
38. The second elytron (× 10).

PLATE 7.

Eulagisca corrientis (figs. 39–42).

Fig. 39. The eleventh parapod, anterior face (× $2\frac{1}{2}$).

40. One of the upper dorsal chætæ (× 45).
41. A ventral chæta from the middle of the bundle (× 45).
42. A ventral chæta from the lower part of the bundle (× 45).

Hermaaion rouchi (figs. 43–47.)

Fig. 43. One of the most dorsal chætæ from a large individual (× 45).

44. The apex of one of the smaller dorsal chætæ from the upper part of a bundle, from one of the smaller individuals (× 250).
45. The apex of one of the largest dorsal chætæ, much worn (× 250).
46. One of the uppermost chætæ of a ventral bundle of a large individual (× 45).
47. One of the lowermost ventral chætæ of a large individual (× 45).

Eulalia hunteri (figs. 48–52).

Fig. 48. Anterior end of the worm (× 9).

49. The head (x 27). Only the appendages of the right side are completed.
50. A parapod, anterior face (camera, × 20).
51. A chæta (× 250): the appendix is not necessarily curved. The outline is too heavily drawn; it is in the object extremely fine. Note the peculiar articulation.
52. A group of pharyngeal papillæ (× 35); three are shown from above.

Eulalia mcleani (figs. 53–57).

Fig. 53. Anterior end (enlarged).

54. A parapod (× 20).

55. A chæta (× 500), side view. The appendix is not necessarily curved.

56. The articulation of appendix (× 500).

57. Pharyngeal papillæ (× 70); the two broader ones are seen in a plane different from the rest. A top view of one is shown.

Pelagobia viguieri (figs. 59, 60).

Fig. 58. (There is no drawing corresponding to this number.)

59. The peristomial cirrus (× 90) showing the axial chitinous support.

60. A portion of the cirrus near the base (× 720), showing the tapering proximal termination of the axial supports, and the thickened cuticle on the posterior face of the cirrus.

PLATE 8.

Vanadis antarctica (figs. 61–63).

Fig. 61. A complete chæta (camera, × 30). It was drawn in two parts, a small bubble of air lay about half-way along, which enabled me to join the two sketches accurately together.

62. Two aspects of the articulation at different foci (× 360).

63. Another form of articulation less commonly met with (× 360).

Tomopteris carpenteri (figs. 64–66).

Fig. 64. Head and first segment (× 10). The cirrus is cut short; its supporting chæta is shown as projecting a short distance beyond the cut end.

65. The head of a soft specimen (× 10), showing the epaulette of the left side triangular, as is figured by Quatrefages for the species.

66. A parapod (× 10).

Nereis loxechini (figs. 67–75).

Fig. 67. Head of a well-preserved specimen (× 10).

68. Head of soft specimen (× 5).

69. A parapod of 20th segment, ventral view (× 10), (*a*) anterior face, (*p*) process of the posterior lip.

70. The 8th parapod in outline ; anterior face (× 20).

71. The 34th parapod in outline; posterior face (× 20).

72. The 80th parapod in outline ; posterior face (× 20).

73. One of the stout brown heterogomph falcigers, from the supra-acicular bundle (× 250).

74. Heterogomph falciger, from the sub-acicular bundle (× 250).

Lumbriconereis macquariensis (figs. 76–81).

Fig. 76. Head, ventral view (enlarged).

77. The 8th parapod (camera, × 90).

78. A posterior parapod (× 90).

79. The only articulated hook which was found (× 360); it occurred in an anterior parapod.

80. The usual form of hook, taken from the 25th parapod (× 360), as seen from the side and from in front, showing the denticulated lower portion of the hood.

81. A capilliform chæta from 8th foot (× 250).

Sphærodorum spissum (figs. 82–84).

Fig. 82. Entire animal drawn from the unstained cleared specimen (camera, × 20).

83. Anterior end of the same (× 70) camera outline. The prepharyngeal region is shown in surface view, except the eye vesicles (?), but the pharynx is at a deeper level; the dark patches in front of it are glands; the bundles of chætæ lie really below the rest, on the ventral surface.

84. The posterior end (× 70), surface view.

PLATE 9.

Sphærodorum spissum (figs. 85–89).

Fig. 85. Portion of the surface of the stained specimen (× 35), showing the ventral surface and a portion of the animal's right side. The outline is drawn under the camera, but details are filled in from various parts of the surface.

86. A portion of the margin of the same preparation (× 45), showing the absence of any definite alternation in size of the papillæ.

87. A papilla (magnified; freehand).

88. A parapod (magnified; freehand), seen from below. Note the thickness of the cuticle.

89. A chæta (magnified; freehand).

Aricia marginata var. *mcleani* (fig. 90).

Fig. 90. One of the anterior neuropods with the additional series of spines behind and below the third row.

Scoloplos mawsoni (figs. 91–94).

Fig. 91. The parapod from the 7th segment (× 45).

92. Parapod from the 24th (× 45).

93. From the 32nd (× 45).

94. From the 53rd segment (× 45).

*83892—Q

Leœna arenilega (figs. 95, 96).

Fig. 95. Anterior end from above (enlarged); most of the tentacles are omitted; a few are shown cut short.

96. Anterior end from below.

Scione mirabilis (figs. 97–100).

Fig. 97. Anterior end, from the side (enlarged), showing the contracted gill, as described for *S. spinifera*.

98. Anterior end of another specimen (a female) with gill extended, as in McIntosh's figure. This was removed from its tube in which it had been preserved.

99. Uncinus from a posterior segment (× 360).

100. Uncinus viewed from above: (*a*) one of the upper ones; (*b*) one of the lower ones.

Polycirrus hamiltoni (figs. 101–106).

Fig. 101. Ventral view of anterior end. Note the nephridial papillæ below the notopods.

102. The 13th parapod, with contained eggs (× 90).

103. Notopodial capilliform chæta, with unsymmetrical flange (× 720).

104. Notopodial capilliform chæta, the slender denticulated form (× 720).

105. Uncinus (× 720).

106. Uncinus from above (freehand) to show the "hood" above the teeth.

PLATE 10.

Phyllocomus dibranchiata (figs. 107–123).

Fig. 107. Entire worm in outline; natural size.

108. The anterior end from in front (enlarged)—*br.*, branchiferous segment; *pe.*, peristomium; *pr.*, prostomial plate; *x.*, nuchal organ.

109. Anterior end from the right side. Letters as above.

110. Anterior end, dorsal view of left side—*g.*, insertion of gill.

111. Transverse section of gill, showing axis and the four lamellæ.

112. Transverse section of a gill-folium (× 45). The blood-vessels cut through are indicated by the rows of black ovals.

113. Anterior end ventral view—*l.*, group of pigment spots; 3., the first chætigerous segment. Other letters as above.

114. Dorsal view of the junction of thorax (*th.*), and abdomen (*ab.* 1) (× 8).

115. Posterior end, side view (× 5).

116. The tentacles displayed within the buccal cavity by slitting the body wall along the dotted lines shown in fig. 113—*m.*, the membrane surrounding the base of the tentacles.

117. A portion of the peritentacular membrane with the tentacles turned forwards, showing the proximal and distal rows of pigment spots.

Fig. 118. A dorsal chæta viewed in the plane with two flanges (× 45).

119. A dorsal chæta viewed in the plane at right angles to the above; it is now curved, and has one broader flange (× 45).

120. A portion of a dorsal chæta lying on its two-flanged side, with the third flange projecting upwards (× 720).

121. The tenth abdominal neuropod (× 20),—*d.*, distal process; *p.*, proximal papilla.

122. Neuropodial uncinus (× 360).

123. The same viewed from above.

Amythas membranifera (figs. 124–132).

Fig. 124. Anterior end dorsal view (natural size). The missing gills are indicated by the dotted lines.

125. Anterior end (enlarged)—*g.*, the anterior gill of right side; *g.* 2, *g.* 3, the gills, or their bases, of the second and third pairs; *br.*, branchiferous segment; *pr.*, prostomium.

126. Side view of anterior region (× 2)—*pe.*, peristomium; other letters as above.

127. Anterior end, seen from in front (× 3), with the tentacular membrane (*t.m.*) pressed downwards—*l.*, lateral region of the lower lip (peristomium); *pr.*, prostomium; *s.o.*, supra-oral arch.

128. View from below of the anterior end, dissected from the left side, and the floor pressed down—*gl.*, ventral gland shields; *l.a.*, lateral region of the supraoral arch; *i.l.*, inner lower lip or sphincter; *nrp.*, neuropods; *pe.*, peristomium; *t.m.*, tentacular membrane.

129. Side view of the abdominal segments.

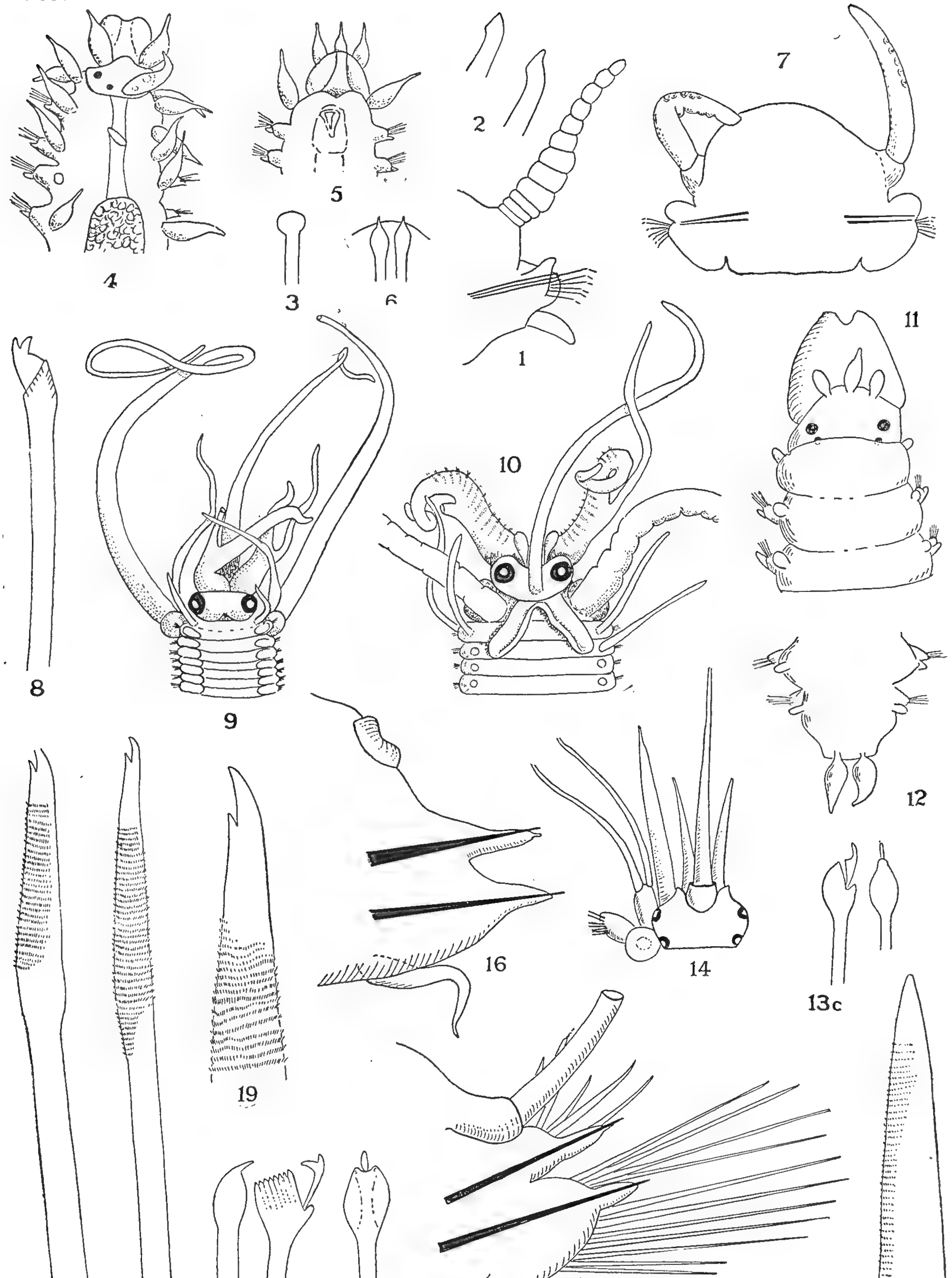
130. Thoracic uncinus (× 360).

131. Abdominal uncinus (× 360).

132. Abdominal uncinus, viewed from above (× 360).

INDEX.

[6 Plates; 1 Map.]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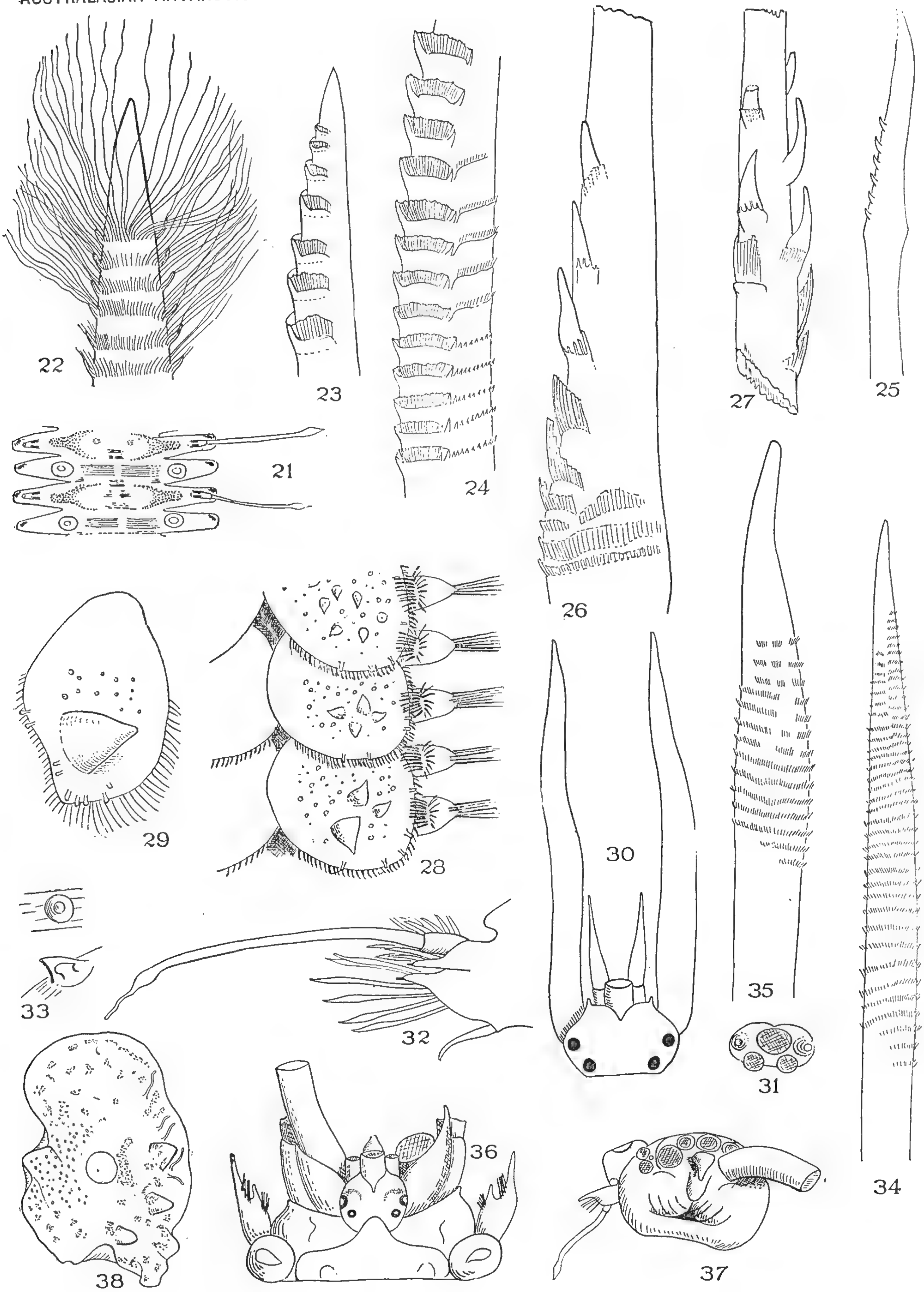
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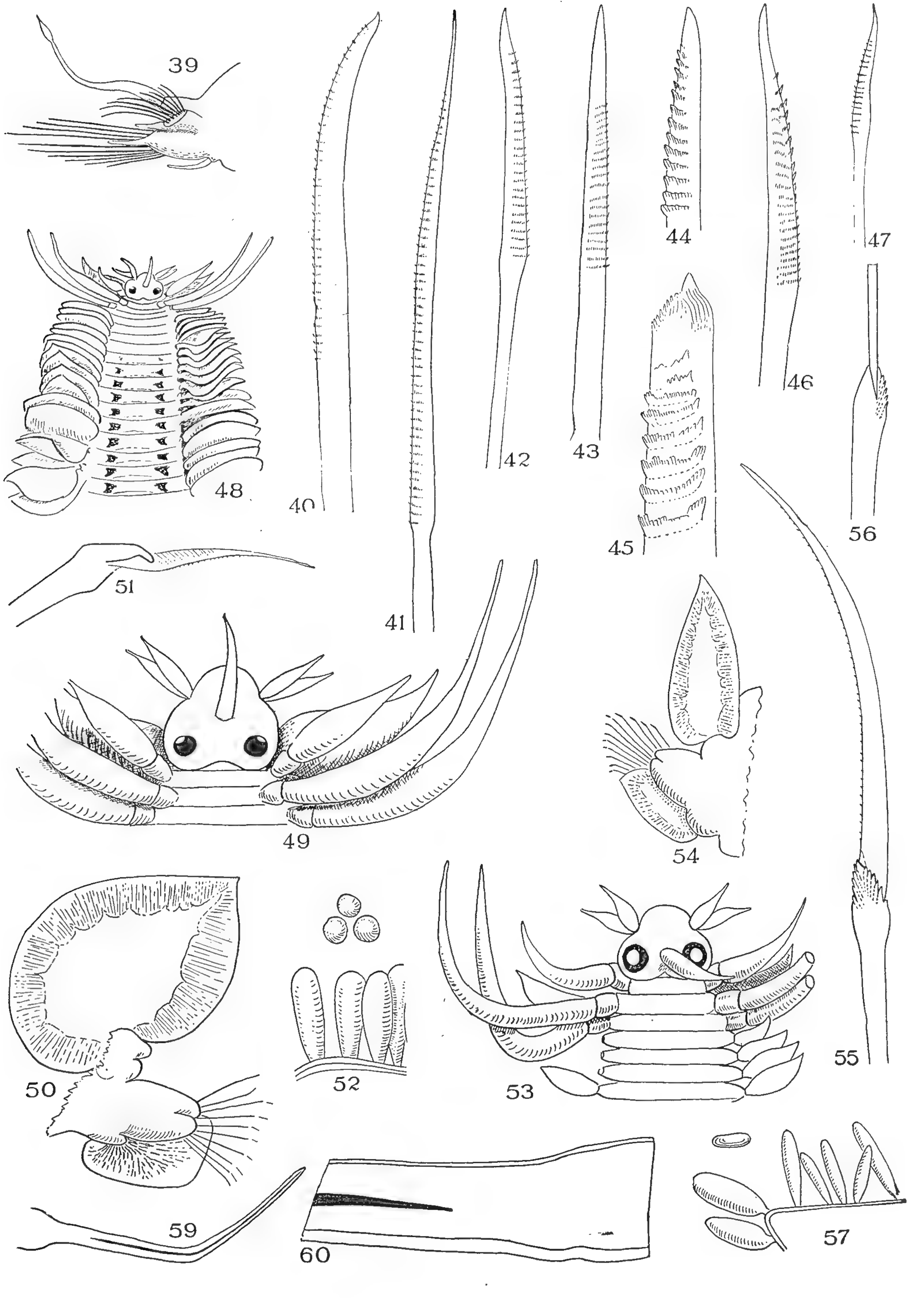
39
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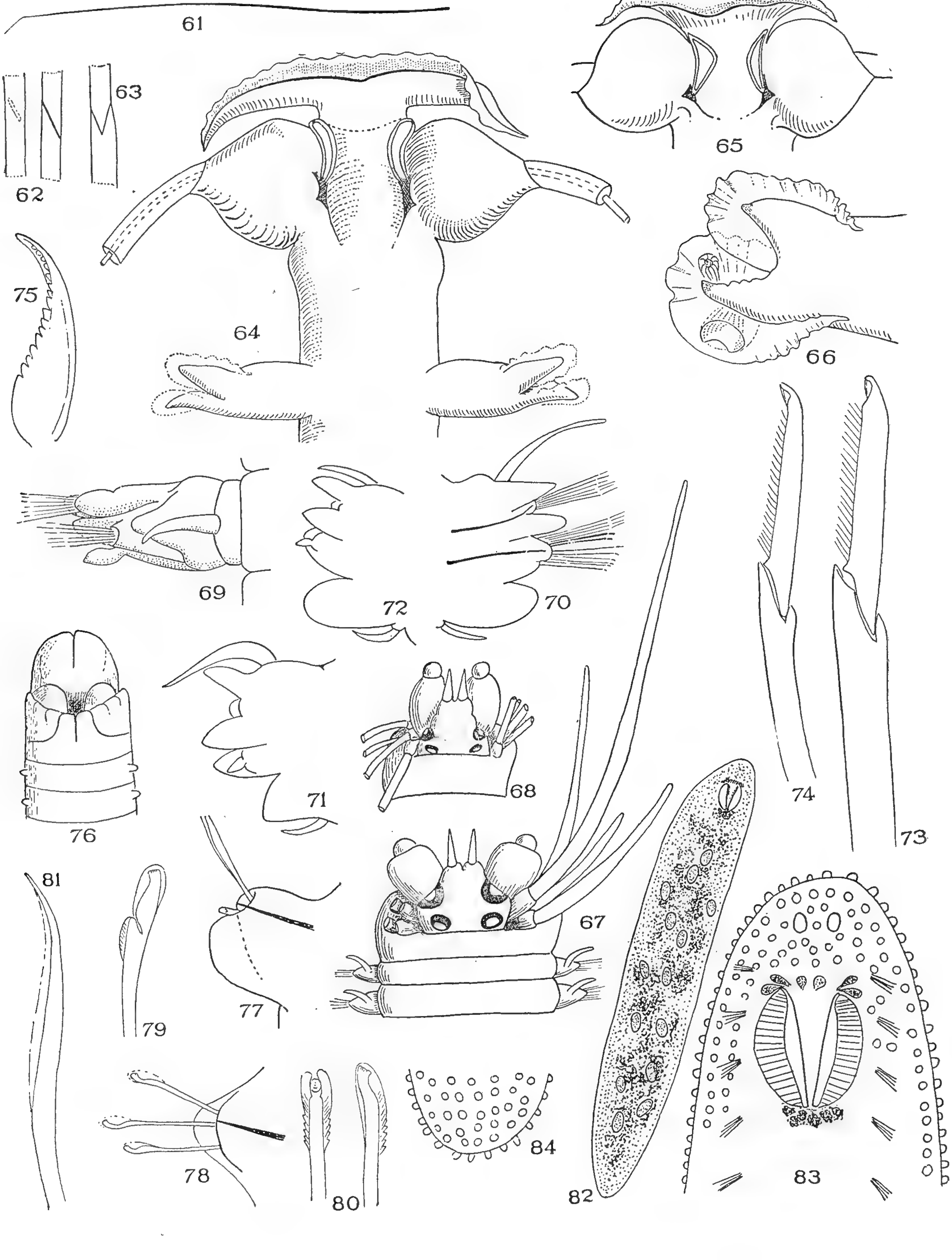
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62
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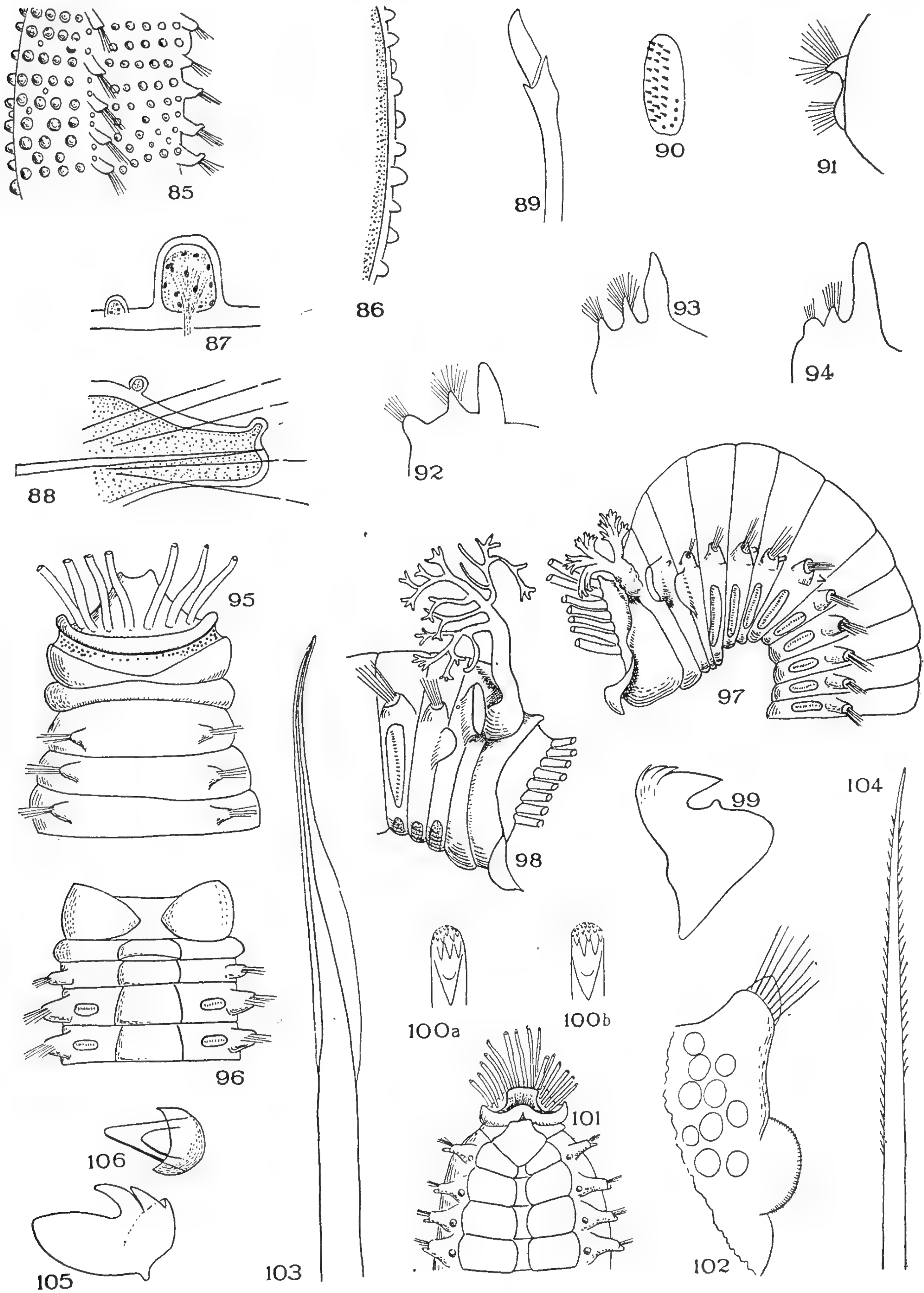
84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100a
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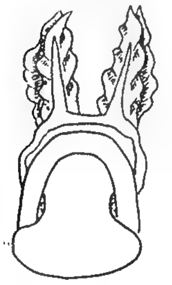
104
105
106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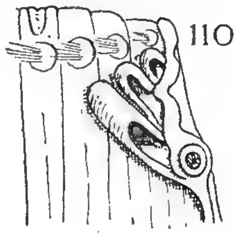
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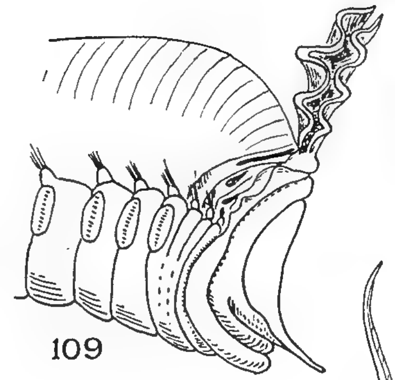
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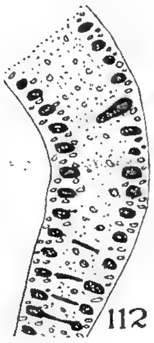
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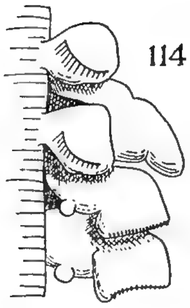
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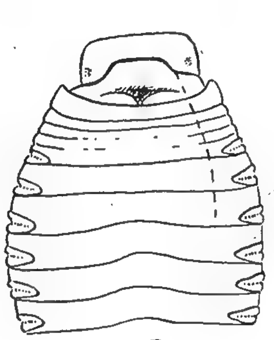
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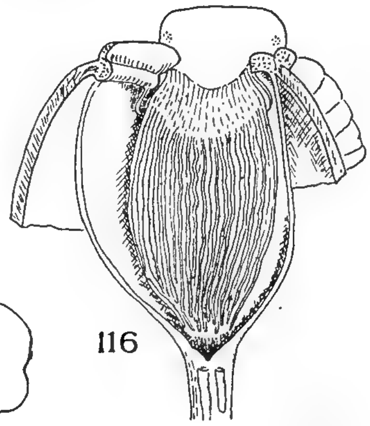
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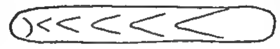
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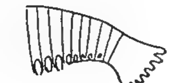
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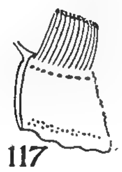
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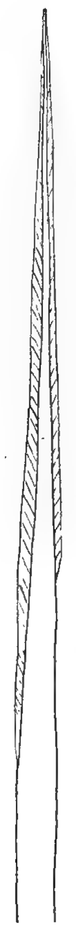
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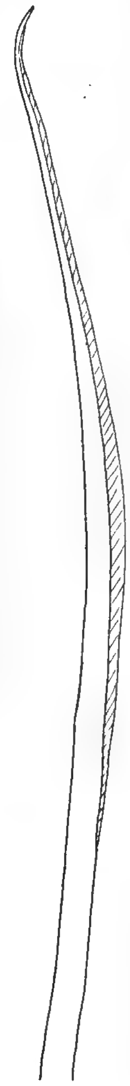
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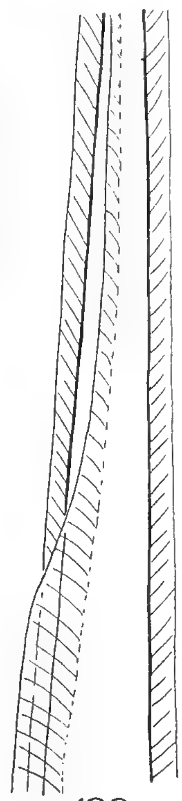
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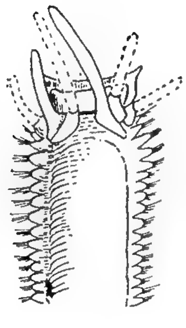
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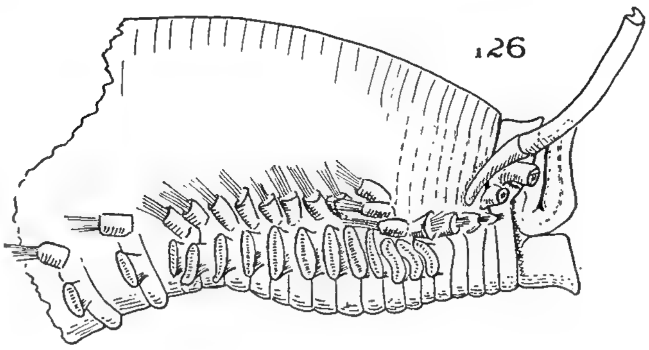
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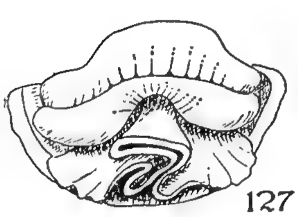
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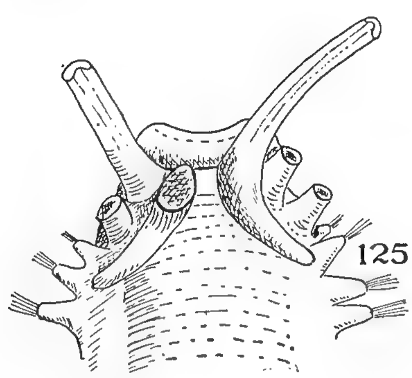
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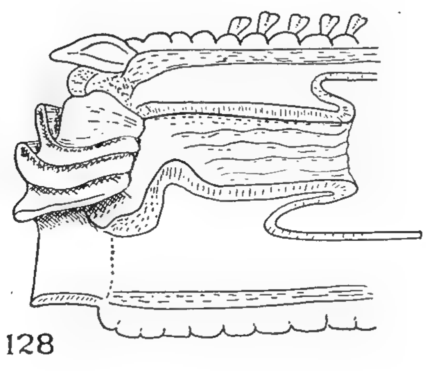
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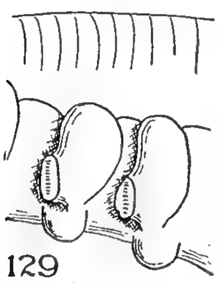
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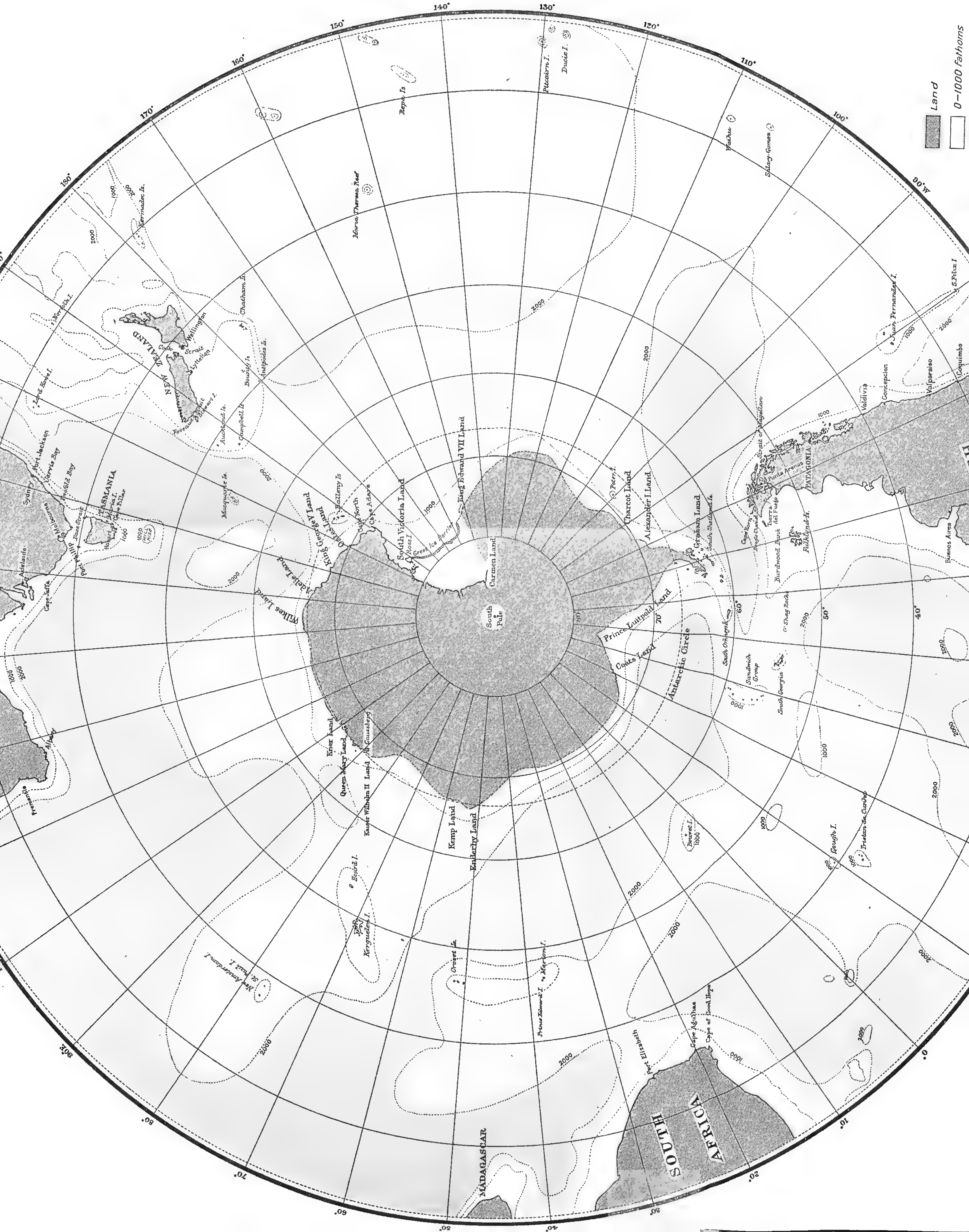
130


131


132



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BY
W. B. BENHAM, M.A. (OXON.), D.Sc. (LOND.), F.R.S., F.N.Z. INST.

WITH FIVE TEXT-FIGURES AND A MAP

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WITH FIVE TEXT-FIGURES AND A MAP

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CONTENTS.

THE OLIGOCHÆTA OF MACQUARIE ISLAND.

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(With five text-figures and a map).

INTRODUCTION.

The present collection is a small one, but, judging from the different parts of the island and the different habitats explored, there is little reason to suppose that much has been overlooked by that assiduous and energetic collector, Mr. Harold Hamilton, Biologist of the Macquarie Island party.

It is true that no specimen of *Enchytræus albidus* was met with in examining the material, which is not to say that it is not present, for I did not study every individual of these small worms, which were collected in considerable numbers.

The material was carefully preserved and annotated. As the geographical and physical features of the island have been dealt with by other contributors to this series of Reports, there is no need for me to say anything as to the topography.

The collection contains representatives of only four species, all of which have already been described. Three belong to the family Enchytræidæ, namely, *Lumbricillus macquariensis*, *Marionina antipodum*, and *M. werthi*. The two last have not previously been recorded from this island. The fourth species belongs to the family Magascolecidæ, namely, *Microscolex* (*Notiodrilus*) *macquariensis*.

The affinities of each of the species appear to be with those inhabiting islands to the west, and after the systematic account of the worms I have added a short Essay on their Dispersal, which may be of some general interest, as the problem is by no means a simple one and has led to much discussion amongst Oligochætologists.

Fam. ENCHYTRÆIDÆ.

LUMBRICILLUS *Oersted.*

LUMBRICILLUS MACQUARIENSIS *Benham.*

L. macquariensis Benham (1905), p. 295, pl. XIV, figs. 8, 11–13.

L. intermedius Benham (1909), p. 261, pl. X, figs. 8–11.

L. macquariensis Benham (1915), p. 189.

The collection contains a considerable number of specimens from both the sea-shore and from fresh-water streams. One lot is labelled by Mr. H. Hamilton as ' Marine worms, found under stones at about high-water mark, apparently in copulation."

It is interesting to note that the original specimens, amongst which was the type of the species, were gathered by Mr. A. Hamilton, the father of the collector of the the present specimens, who found them " in brackish pools, with Siphonaria, &c."

I commenced the study of these Enthytræids from the Macquarie Island some years ago, and have already published a short article on this species in which I show that it is identical with the worm I named in 1909, *L. intermedius*, and it is convenient to quote from that article so as to bring together here the evidence for this opinion.

While studying the present Enchytræids I was led to re-examine my preparations of the specimens received at earlier dates, and have arrived at the conclusion that the species " *L. intermedius* " is identical with *L. macquariensis.*

A comparison of the two accounts shows that the points of difference affect the following organs: (*a*) The nature of the spermathecal opening into the œsophagus; (*b*) the number of chætæ in each bundle; (*c*) the segment in which the dorsal vessel becomes free from the intestinal blood sinus; (*d*) the number of the sub-neural copulatory glands; (*e*) the size and proportions of the spermiducal funnel.

A. The re-examination of the type of *L. macquariensis*, and of sections made of other specimens received at that time, shows that I made an error in affirming and figuring the existence of " a narrow duct " putting the spermatheca into communication with the œsophagus. And to this error I added some confusion in a note at the end of my account of " *L. intermedius* " by stating (1909, p. 261), " It is quite distinct from *L. macquariensis*, which belongs to another group of the genus in which the spermathecal duct is strongly marked off from the ampulla." The latter statement is clearly a *lapsus calami*, for what was intended is evidently a contrast with the " narrow communicating-duct," and not with the external opening.

But it is difficult now to understand how I came to make the original statement as to the existence of the " narrow communicating-duct." The series of transverse sections show quite distinctly that there is no such " duct "—the ampulla communicates with the œsophagus by a small pore due to the sudden contraction of the ampulla, as I have described and figured for " *L. intermedius* " (pl. X, fig. 8).

In order to convince myself further I opened a specimen from the original lot, and it is certain that no such "duct" exists. The mounted specimen which served as the type, when studied without the knowledge derived from the other studies, does suggest a short duct, as the spermatheca is bent at a point close to its entrance into the œsophagus; but with the other evidence before me I recognise that the statement was due to faulty observation. (It is worth noting that Michaelsen made a similar error in his first account of *L. maximus*.)

Having discovered this mistake I proceeded to examine each of the other characters more carefully.

B. As to the chætæ, I find from a study of eight individuals that there is a considerable range of variation, as may be seen by a study of the annexed table, in which I have summarised the number of chætæ in the dorsal and ventral bundles in the pre-clitellar and in the post-clitellar region of the body in specimens from Macquarie Island and from the Campbell and Auckland Islands. It will be noted that the difference between extremes such as No. 2 and No. 5 amongst specimens from Macquarie Island is greater than the difference between No. 2 and No. 8 from two distant islands, and it is impossible to include in the diagnosis of a species a character with such a wide margin of variation.

C. It will be noted, too, that the segment in which the dorsal vessel originates shows a similar variation. It is true that in the type it commences at the hinder end of the 13th or 14th segment, while in the type of "*intermedius*," as I can confirm from renewed examination, this point is in segment 17; but even amongst those from Macquarie Island the position varies, being in two cases in the 15th, in a third in the 16th, while in one that was sectionised it lies in the 17th segment.

D. The number of the sub-neural glands exhibits the same instability, for though usually there are three glands in segments 14, 15, and 16, there is one individual from Macquarie Island in which there are six glands, and in two "*intermedius*" there are four.

E. Finally, I made a point of the proportion of length to breadth of the funnel of the sperm-duct, for in the type of *L. macquariensis* I stated that the length is twice the breadth, whereas in "*L. intermedius*" I gave it as about five times the breadth. I have measured it in three funnels of "*intermedius*" whose outlines I drew with the camera, two in a series of longitudinal sections, and one in a bisected specimen mounted as a transparent object. From these measurements I find that the length is respectively five, five and a half, and six times the breadth.

I am unable to give measurements for the funnel of *macquariensis*, as it is bent in all the preparations, but the proportions given in the original statement seem to be borne out. But the state of preservation of the type is bad; the worm was soft, and it is possible that the gland-cells around the funnel are much swollen, just as those of the sub-neural glands are. In my figure of the latter (1905, pl. XIV, fig 8) they are represented as much too broad and too high. Without at that time having well-hardened specimens for study, I did not recognise the effect of this bad preservation on the gland-cells; but a comparison of the sections with well-preserved material shows at once the fact that the gland-cells are swollen, so that the whole gland appears larger than it would be in life. Hence again the difference between the figure of *macquariensis* referred to and that given for "*intermedius*" (1909, pl. X, fig. 9).

So, I think, we may take it that in the case of the funnel gland-cells the same explanation may be given—their swollen condition increases the width of the funnel, and led me to give proportions which are no doubt untrue in life. It is not improbable, however, that the size of the gland-cells in both glands may vary according to the sexual condition of the worm, and it is likely that when fully mature in the breeding season the glands would be larger. I conclude, then, as a result of this comparison, that "*L. intermedius*" is synonymous with *L. macquariensis*, so that this species has a distribution over these three Subantarctic islands. The figures of the spermatheca, sub-neural glands, and sperm-funnel as given for "*intermedius*" must replace those given in the article on *L. macquariensis*.

Moreover, it is, it seems to me, closely allied to *L. maximus* Michaelsen (1905, p. 10), from which it differs in its smaller size, for that is stated to measure 40 mm. in length, whereas our species does not exceed 25 mm., and some of the mature individuals are less and the worm may attain maturity when only 15 or 16 mm. in length; and the variety of *L. maximus* termed "*robinson*" is but 12–16 mm. in length, and the clitellum is interrupted on the ventral surface.

TABLE SHOWING THE NUMBERS OF CHÆTÆ, ETC.

	Chætæ.				Sub-neural Glands.	Origin of D. Vessel.
	Pre-clitellar.		Post-clitellar.			
	D.	V.	D.	V.		
1. *L. macquariensis* (type)	6 (5)	5 (4, 6) *a*	4 (5)	5	14, 15, 16	13 or 14
2. ,, (cotype) ...	6 (7)	6 (5)*b*	5 (4)	6 (5)	14, 15, 16	?
3. ,, (H. H.) ...	5 (6)	6 (5)*a*	4	5	14, 15, 16	16*c*
4. ,, (H. H.) ...	6 (7)	7 (6, 5)	?	?	*d*	15
5. ,, (H. H.) ...	4	5 (6)	3	4	14, 15, 16*d*	15
6. "*L. intermedius*"	5	6	4	5	14, 15, 16, 17	17
7. ,, ...	5	6 (7)	4	3 (4)	14, 15, 16	16
8. ,, ...	6 (5)	7	5 (4)	6 (5)	14, 15, 16, 17	?

NOTES TO THE TABLE.

The numbers enclosed in brackets occur less frequently along the body.

a. In one segment there are 7 chætæ.

b. There is considerable irregularity throughout the body in this individual, the number in each bundle often differing in successive segments, and on the two sides of the body; thus each of the segments ii and iii has 8 chætæ on one side and 6 on the other.

c. In one individual sectionised the dorsal vessel occurs in the 17th segment.

d. In one individual there are 6 glands in segments 13-18, the largest being in the 15th; but in two other specimens only 3 glands exist, but I did not correlate them with the chætal formula.

? The fact was not observed in these specimens.

H. H. Specimens collected by Mr. H. Hamilton during the present expedition.

Localities.—

(*a*) Under stones at about high-water mark.

(*b*) From algæ above high-water mark (with *Marionina antipodum*).

(*c*) No particulars (with *M. antipodum*).

(*d*) In fresh-water creeks.

(*e*) In fresh-water streams, top of hill, North End.

Distribution.—Macquarie, Campbell, and Auckland Islands. As this species seems nearly related to *L. maximus* Mich., which occurs on the Crozet group, it is likely that it has arrived in these islands from the west.

MARIONINA *Michaelsen.*

MARIONINA ANTIPODUM *Benham.*

Benham (1905), p. 294, pl. XIV, figs. 9, 10.

Benham (1902), p. 262.

(Fig. 1.)

As a result of the examination of the abundant material gathered during this expedition I find it necessary to make a few corrections in, and additions to, my previous account, and although this note occupies but a few lines in the Report, yet the sectionising and study of the preparations have occupied me many hours and days before I was able to satisfy myself of the identity of these small worms. Any zoologist who has had to study these microdrilous Oligochætes will know how difficult it is to make comparisons with other species, from the study of preserved material and from sections cut in different planes.

Several specimens from different localities were measured; the mature worms do not seem to exceed 15 mm. in length with about forty segments.

The chætæ are not so constantly four in each bundle as stated in my original account, for I find worms in which this number is exceeded; indeed, in some segments of one worm the number is seven in the anterior segments.

The original material consisted of four worms, two of which were mounted entire, one was cut into transverse sections, the fourth I have lost.

Of the two individuals mounted, one is a small immature worm in which it is true that there are almost universally four chætæ in each bundle, the number sometimes being less; but in the other larger and mature specimen the numbers are greater.

Other specimens from the present collection were also analysed for this purpose. In the anterior or preclitellar segments there are more usually six or five in the ventral bundle, and five or four in the lateral; in the postclitellar segments the numbers are four ventrally and four laterally, though occasionally five and three respectively. The higher figure occurs in the most anterior segments.

I am now also able to give a more complete account of the penial apparatus, more especially of the prostate glands, than I did in my original contribution. There I gave a figure (pl. XIV, fig. 9) of the apparatus as seen in transverse sections, and it shows only one group of gland cells, lying external to and above the penial bulb, into which it opens. This is correct so far as it goes, but a re-examination of the sections in the light of observations on longitudinal sections made from worms of the present collection, shows that there are in addition one or more post-penial glands.

Some of the worms were sectionised in the sagittal and another in the frontal plane, so that the extent of these glands is more evident (fig. 1). There are two or three groups of gland cells in front of, and one or two behind, the penial bulb; each group extends upwards inside the body wall for some distance, as seen in transverse sections, to about the level of the side of the intestine. These glands all open into the penial bulb or atrium.

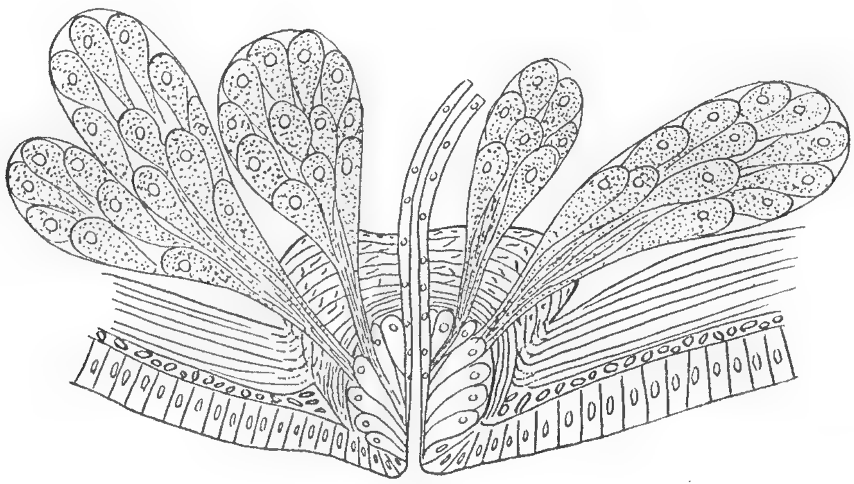

Fig. 1.

Marionina antipodum. Schematic view of the penial apparatus (x 250, approx.) compiled from a series of outline camera sketches of longitudinal sections, controlled by comparison with transverse sections. The sperm-duct passes through a subspherical group of gland-cells forming an "atrium," which is enveloped by a coat of muscle; the various prostate glands open into this "atrium," the cells of which take a stain less deeply than do the cells of the prostate.

The sperm duct, as I described it originally, enters the small bulb obliquely; this bulb consisting of a group of gland cells, whose contents do not stain as deeply with borax-carmine as do those outside the bulb, and they are surrounded by a muscular coat.

The lower part of the sperm duct loses its cilia and into this distal region the gland cells of the bulb enter. This penial bulb is, then, a typical "Lumbricillid bulb," as defined by Eisen (1905), whose paper had not reached me when I described the species.

There is a pair of extensive copulatory glands, also known as "ventral glands" and "sub-neural glands," in each of the segments 13, 14; they extend outwards from the nerve cord for a distance greater than its breadth. Here, again, I was in error in my account of the type. The type is very faintly stained, and, owing to its position as it lies on the slide, these glands are not readily seen, while the series of transverse sections unfortunately ceases just in front of the former segment. My attention was drawn to these glands by finding them in individuals in the present collection, and re-examination of the mounted type shows that they exist there.

In this species the œsophagus and intestine are covered with cells containing abundant chloragogen granules of dark yellow or even brown colour. So deeply

tinted are they in some cases that the brown can be seen through the body-wall even now that the worms are in alcohol; in several instances the granules are darker on the œsophagus than further back.

In *Lumbricillus macquariensis*, on the other hand, these granules are very feebly coloured yellowish or very pale brown; indeed, in some series of section the cells do not appear to contain any pigment, being filled with pink-stained granules. This absence of dark pigmentation was useful in enabling one to sort out one or other species from a mixture of the two; in each case the optical test was confirmed by means of sections and study of the organs.

Localities.—

(*a*) About fifty individuals "from algæ above high-water mark, West Coast."

(*b*) About thirty individuals of smaller size without definite locality.

(*c*) A number from "fresh-water creeks" (with *L. macquariensis*).

(*d*) A considerable number "from fresh-water stream, top of hill, North End." (with *L. macquariensis*).

This last lot had been preserved in osmic acid and are of a very dark grey.

As I have remarked in 1909, this species appears to be related to certain species inhabiting the Crozets and Kerguelen; and it is by no means easy to be sure that they are different from one of these species, for specific characters are in the case of these small worms difficult to express in words.

The species was originally found on Antipodes Island, and its occurrence on Macquarie Island is of particular interest, as it was not met with either on Campbell or Auckland Island, though it is of course still possible that it lives on one or both of them. If it does not, then its presence on Macquarie Island opens up a question which I discuss later. It is fairly common on Antipodes Island, and it may be that cocoons have been brought on the feet of birds to Macquarie Island, though I am not inclined to take that view.

MARIONINA WERTHI *Michaelsen.*

Michaelsen (1905), p. 13, pl. I, figs. 3–5.

(Figs. 2–5.)

Amongst the material gathered from the algæ above high-water mark mixed with the two preceding species were some half-dozen small worms of a grey colour. The presence of pigment in the body-wall is a very unusual phenomenon amongst the

Enchytræidæ, and the only species in which this pigmentation occurs in the longitudinal muscle-coat is this species, which was recorded from Kerguelen, where it also was found amongst algæ within tide marks.

The present worm may attain a length of 10 mm. by 1 mm. in diameter.

The pigment, as seen in a complete worm, covers the dorsal surface throughout its length; it extends down the sides as far as the lateral chætæ in the anterior region, while still further forwards it extends across the ventral surface. Owing to this extensive pigmentation it is impossible to make out much of the internal anatomy in an entire mount. Seen under the microscope the pigment is in the form of a dense network, which in the greater part of the worm is interrupted intersegmentally by narrow unpigmented bands, though between the anterior half-dozen segments these are absent.

Sections show that the pigment granules are dispersed throughout the longitudinal muscle layer (fig. 2), as Michaelsen has described; the granules are intensely black in the innermost portion below the cœlomic epithelium, and become paler as the circular layer of muscles is approached.

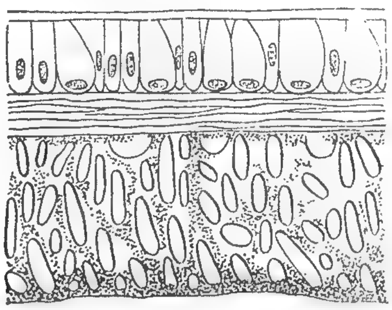

Fig. 2.

Marionina werthi. A portion of a transverse section of the body-wall (camera, x 500). The pigment granules, contained in the cells within the longitudinal muscle-coat, are almost black just within the cœlomic epithelium, but get paler as they approach the circular coat.

The chætæ are more numerous in the bundles than in the type, for Michaelsen found 7–10 in the ventral bundles of the anterior and middle region, and 5 or 6 in the lateral bundles. I find, however, as many as 10–13 ventrally, and usually the higher number in the preclitellar segments, and 8–10 in the postclitellar segments occasionally only 7.

In the lateral bundles anteriorly there are 8–11 chætæ, and further back 7 in a bundle.

The specimen from which these numbers were obtained measures 9 mm. in length and contains 40 segments.

The inequality in length of the chætæ, their sigmoid form, and the fan-shaped arrangement are as Michaelsen has described. In each bundle the chætæ form a series of increasing length, the shortest in the ventral bundle being at the ventral end of the series, and in the lateral bundle at the dorsal end of the series.

In one other point my specimens differ from Michaelsen's account, and were it not that the pigmentation is so unusual I should be inclined to make a new species

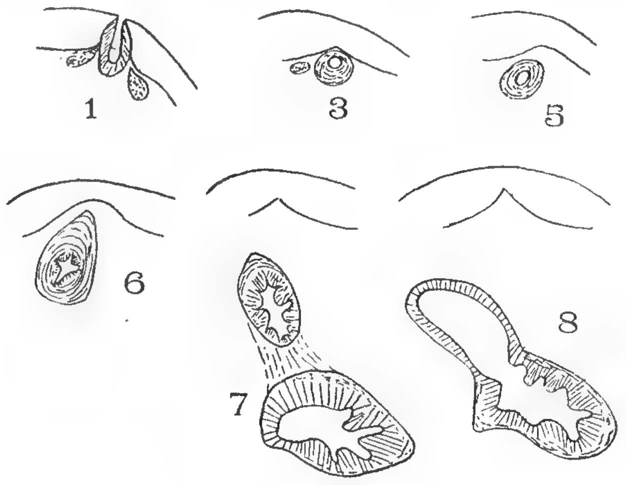

Fig. 3.

Marionina werthi. A series of camera outline of the spermatheca (x 140). The numbers below the figures indicate the number of sections in the series, the last four being consecutive sections. The first sketch shows the pore, the last the opening into the œsophagus. The organ is U-shaped, as is indicated by the relative position of the notch in the body wall. The muscular duct is distinct.

for it. He states, in regard to the spermatheca, that it exhibits no sharply marked duct, whereas I find a distinct muscular duct of some length (fig. 3). There are two groups of gland cells at the pore, one in front, the other behind; these open into the distal end of the duct (fig. 4).

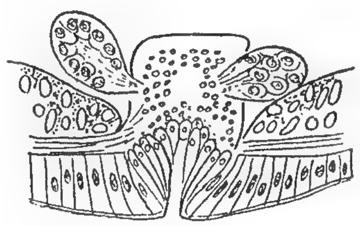

Fig. 4.

Marionina werthi. The spermathecal pore, with its two glands. The pore itself is surrounded by gland cells of a different character (x 250).

The most interesting part of the internal anatomy concerns the condition of the "penial apparatus"; that is, the penial bulb and its associated glands. Michaelsen states that the sperm duct, after coiling, opens into a minute onion-shaped bulb ("zwiebelförmig Bulbus"), entirely embedded in the body-wall, and that beside it are the prostate glands.

At the time he wrote Eisen had not drawn attention to the importance of the structure of the penial bulb in classifying the Enchytræidæ, and though Welch (1914) has recently criticised some of his conclusions as having been founded on too limited a number of species, yet he admits (1920) that the importance of the structure remains. The apparatus is very different from that met with in *M. antipodum* and other species. There is, so far as I can make out from my sections, no "bulb" in the sense in which the term is used in *Lumbricillus*, &c. The sperm duct passes nearly vertically into the

body wall, between groups of gland cells constituting the prostate gland; it runs down on the mesial side of one of these groups, to perforate the body wall simply; there is neither glandular investment nor muscular covering (fig. 5).

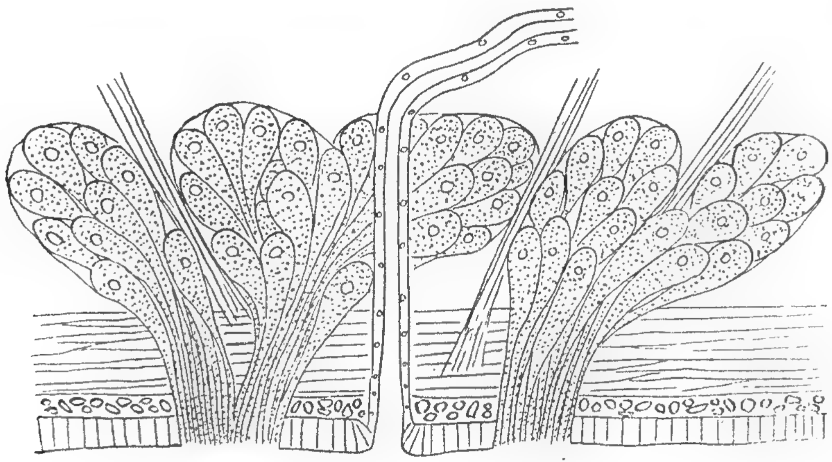

Fig. 5.

Marionina werthi. Schematic view of the penial apparatus (x 250, approx.) compiled from camera sketches of a series of longitudinal sections. The sperm-duct passes directly to the exterior, and the prostate glands open independently of the sperm pore.

The prostate glands, some in front of, and others behind the sperm pore, rise up inside the body-wall to the level of the intestine and are separated from the body-cavity by a sheet of obliquely vertical muscles fibres; a few fibres also pass between the groups of gland cells. The glands open through the body-wall independently of the duct.

In short, the penial apparatus recalls that defined by Eisen as being characteristic of the genus *Enchytræus*, though it has not this simple structure in *E. albidus*.

Stephenson (1911) has pointed out that the distinction between the genera *Enchytræus* and *Lumbricillus* is not so rigid as was formerly supposed; and Welch (1914) states that in regard to the penial apparatus the genus *Enchytræus* presents every grade between that regarded as typical of the genus and that regarded as typical of the genera *Lumbricillus* and *Marionina*.

That the latter genera are very closely alike is evident from the remarks made by Michaelsen with respect to the present species, when he states (p. 15) that he was at first in doubt as to whether the species should be placed in *Marionina* or in *Lumbricillus*, but that the structure of the male apparatus determined him. At the same time it is interesting to note the resemblances of the species to the genus *Mesenchytræus*, from which it is distinct enough in regard to this apparatus.

Locality.—

Macquarie Island, high-water mark.

Distribution.—Kerguelen.

Family MEGASCOLECIDÆ.

MICROSCOLEX *Rosa, sensu lato Michaelsen.*

MICROSCOLEX (NOTIODRILUS) MACQUARIENSIS *Beddard.*

Acanthodrilus macquariensis Beddard (1896), p. 208.

Notiodrilus macquariensis Michaelsen (1900), p. 130.

Acanthodrilus macquarensis Benham (1901), p. 132, pl. ii.

Notiodrilus macquarensis Benham (1903), p. 276, pl. xxvi, figs. 3, 11.

Microscolex macquariensis Michaelson (1907), p. 143.

Notiodrilus macquariensis Benham (1909), p. 275.

This, the only "earthworm" that has been found on Macquarie Island, was obtained by Mr. Hamilton at two localities—

(*a*) Eight individuals were found "under stones and decaying vegetation near the Victoria penguin rookery, North End (25, vi, 13)."

(*b*) Three individuals "from crevices in rocky cliff, 150 feet above sea-level, and near the sea in the neighbourhood of the Nuggets."

The worms are described as "flesh-pink" and as "red to pink" respectively; most of them are mature, and the largest measures about 65 mm. in length; as it is more or less curved, one can only give the approximate length. This specimen is larger than the average, which is about 55 mm.

The species differs from *N. aucklandicus** Benham and from *N. campbellianus* Benham in colouration during life, in dimensions, in the character of the ornamentation of the penial chætæ, in the chætal formula, as well as in various internal features, as I have noted in previous articles.

The penial chæta in the unworn condition bears triangular processes or "thorns" (figured by me in 1903), and even in the worn condition, though the thorns may have become more or less obliterated, the pattern remains; a pattern which is very different from that of the other two species in the New Zealand area, as I have already pointed out (1909, p. 274).

In addition to the pair of functional chætæ, there are three other pairs of successively smaller ones, whereas in *N. aucklandicus* I see only one pair of successional chætæ in the bundle.

* It seems unnecessary to repeat the formula "*Microscolex (Notiodrilus) macquariensis*" each time reference is made to this and allied species; so I shall for brevity speak simply of "*Notiodrilus.*"

Two species, however, occurring outside this area have a somewhat similar pattern, namely, *N. crozetensis*, and *N. kerguelarum* Mich., but the shape of the penial chæta in each exhibits differences.

The spermatheca possesses the usual two diverticula, each of which is somewhat enlarged at its distal end, and has a contracted neck where it springs from the spermathecal duct; the two diverticula arise from this duct at opposite sides (1903, pl. xxvi, fig. 3).

The form of the diverticulum resembles that in *N. campbellianus*, in which, however, the two arise close together, as they do in *N. aucklandicaus.*

In the fact that the diverticula spring from opposite sides of the duct, *N. macquariensis* resembles *N. crozetensis*, but in this species the diverticula are much shorter.

On the whole, then, it seems that the present species is related, on the one hand, to *N. campbellianus*, and on the other, but more closely, to *N. crozetensis.*

THE ARRIVAL OF THE OLIGOCHÆTA ON MACQUARIE ISLAND.

A question of much interest naturally presents itself: How did *Notiodrilus macquarienisis**, *Lumbricillus macquariensis*, *Marionna antipodum*, and *M. werthi* reach this island? And a further question requires an answer: Whence did they come?

Species of *Notiodrilus* are known on the neighbouring Campbell and Auckland Islands, lying to the south of New Zealand, as well as on the South island of that country; and also on certain islands in the Subantarctic ring to the west, namely, Kerguelen, Crozet, Marion, South Georgia, and Falklands, as well as on the southern portion of South America.

An important fact about several species of *Notiodrilus* was pointed out years ago by Michaelson—not only do they live on land, but they may live within reach of the salt water. Thus *N. kerguelarum* Grube, was found at the foot of a cliff along the seashore within reach of the spray from the surf at full tide; *N. georgianus* Mich. occurs in a similar situation. Hamilton found some individuals of *N. macquariensis* in a cleft in a cliff 150 feet above high-water mark, and so no doubt within reach of the spray in these stormy regions, but also on higher ground; while I found *N. aucklandicus* not only under logs in the higher country, but also in soil at a spot about a foot above the sea on the shore of Carnley Harbour; so that its habitat was no doubt salt.

* Although strictly the worm is placed in the wider genus *Microscolex*, it is less cumbrous and less confusing to use the subgeneric title only in this portion of the Report.

To such worms that may pass down from a true terrestrial habitat to the sea shore so as to be within reach of the salt water Michaelsen has applied the term Euryhaline.*

It is evident that such worms are not, as are most earth worms, injured by a certain amount of salt water, and this seems to introduce into the problem of their means of dispersal factors which are not involved in the migration of true earthworms.

It seems to me that the answer to the first question should be applicable to other terrestrial and even some littoral animals that have a geographical distribution similar to that of these worms; and it is not necessary that the method by which Macquarie Island was peopled by these animals should be the same as that by which it was peopled by the higher plants, a subject that has been fully discussed in a masterly manner by Cheeseman (1919).

There are several possible ways in which animals may have arrived here from oversea.

1. Stephenson (1921) accounts for some of the similarities between the Indian and Australian earthworm fauna by assuming the polyphyletic origin for certain genera, for which he shows good reason. But this will not apply to the case of the sub-antarctic islands, for here we have undoubtedly one and the same genus.

2. He has noted, too, the existence of natural rafts or floating islands covered with vegetation, and gives his reasons for believing that, in that region at any rate, this means of transportation is fairly frequent. But in the Subantarctic region such floating masses of terrestrial vegetation are out of the question; the lands and islands in these southern latitudes are not of such a character as to allow such rafts to be detached, while, even if they were detached, they would soon be destroyed by the storms at sea.

3. The attachment of cocoons to the feet or other parts of birds may perhaps be one means of distribution in some parts of the world, but I cannot suppose that birds would fly from, say, Kerguelen to Macquarie Island, a distance of 3,250 miles, without settling on the water, for then, of course, the mud on their feet and any cocoons attached to or embedded in it would be washed off. Moreover, one may inquire: In what manner would the cocoons become attached to the feet of the birds? We do not know whether *Notiodrilus* deposits its cocoons near the surface of the soil, or whether at some depth below the surface, as in the case of purely terrestrial earthworms, such as those in New Zealand. If the latter be the case, then it is impossible to suppose that the cocoons would ever get attached to the birds' feet. If, however, the cocoons are laid superficially in the mud near the shore, it is possible that marine birds might

* It appears that this term was originally used by Möbius for those species of animals whichcan live in water the salinity of which varies between wide limits.

carry them away in the mud. And since Macquarie Island is only about 400 miles distant from Auckland Island, and only a little further from Campbell Island, it is quite possible for a bird to fly that distance in some twelve hours, or if the wind were favourable in less time. But, again, would the bird be able to travel that distance without alighting to feed or to rest?

Are there any facts to enable us to decide that point? I do not know of them.

Now, although one may consider the possibility of a passage from either of these islands to Macquarie, yet, since *N. macquariensis* seems, as I have pointed out, to have closer relations to *N. crozetensis* than to *N. campbellianus*, we must look rather for a means of passing from some of the islands lying to the west of it.

It does not seem useful to consider the supposition that cocoons might be conveyed in the intestine of the bird, as seeds of plants may be, for it is doubtful whether they would be able to withstand the action of the digestive juices of the birds' alimentary tract.

4. A fourth means has been suggested by Michaelsen to account for the distribution of the genus from the South American continent to the various islands round the Antarctic, viz., by floating kelp carried by the West Wind Drift.

Machelsen (1911, p. 542) states that he found on the shore of South Georgia a small mass of tangled sea-weed amongst the detritus on the beach; in and on this kelp there were at least one hundred cocoons of *Lumbricillus maximus*, a species of Enchytraeid with a distribution somewhat similar to that of *Notiodrilus*.

On this fact he builds up an enticing hypothesis—that, if the cocoons of the euryhaline *Notiodrilus* were likewise deposited in such a mass of kelp, they, too, might be carried by the West Wind Drift from Kerguelen to Macquarie. It would, he states, take about 202 days—that is rather more than half a year—to travel the distance.

It is true that Michaelsen asks himself the question: whether *Notiodrilus* would survive so long a journey and so lengthy an exposure to the sea; but he believes the answer to be in the affirmative. I confess I doubt it.

No experiments have been made with the object of ascertaining this; and, as Stephenson remarks, it is difficult to plan such an experiment to test the length of time an earthworm or its cocoon can survive in water, either fresh or salt.

And although Michaelson admits that we do not know how long is occupied by the development within the cocoon of *Notiodrilus* or any other earthworm, he makes this further assumption: that if the cocoons were deposited in cold weather on Kerguelen they would reach Macquarie in the warmer months of the year; when being landed, the young worms would hatch out and start a new colony in the new habitat.

I think that Michaelsen would agree with me that this is mere speculation, although a very interesting one, but with very few facts to support it.

He does not state definitely that the eggs or young of *Lumbricillus* that he found in the cocoons were still living when he discovered them. He gives no evidence that this mass of seaweed had come from any distance; and it may be that it had been torn off the rocks on the neighbouring part of South Georgia coast, and had not been in the sea for any length of time.

Again, no evidence is afforded that the cocoons were deposited in the kelp, before that weed had been torn off the rock, wherever that took place. According to his own account, this Enchytræid lives at South Georgia amongst the detritus on the seashore, under stones and logs, and lays its cocoons there amongst.

It seems to me quite possible that the tangle of weed may have been lying on the shore for some days before he found it—I do not find any statement that forbids that suggestion—and that the cocoons had been deposited thereon after it had arrived on the shore.

Unfortunately, he does not give a botanical name to this particular mass of seaweed; if it is anything like the kelp that grows round the shores of the New Zealand islands, *e.g.*, *Macrocystis*, or *D'Urvillaea*, &c., which grow just below low-water mark, under water, therefore, and the cocoons were laid therein before the kelp was torn away from its attachment to the submerged rocks, it would of course mean that the worms actually live in the sea or at least have entered the sea in order to lay their cocoons.

We do not know this, but it seems highly improbable. Moreover, we do not know where *Notiodrilus* lays its cocoons, whether in the soil or in mud above high-water, or amongst algæ.

After considering all these matters that are "unknown," it seems to me that Michaelsen's hypothesis—that the cocoons of this earthworm may be transported over the sea amongst floating algæ for immense distances and during a great period of time—is not supported by his discovery of the cocoons of the Enchytræid amongst the mass of kelp on shore.

As to the period of time occupied by development, an examination of the literature dealing with European earthworms—either the memoirs of the earlier naturalists, such as D'Udekem and Hoffmeister; of the embryologists, like Kleinenberg, Kowalevsky, Vejdovsky, and Wilson, or any modern text book—affords but little satisfactory information as to the period lived within the cocoon, and rather divergent statements as to the season of the year at which the cocoons are laid. No doubt temperature and climate have something to do with this. Some authors give the summer months, some the winter months; others state that cocoons are laid all the year round, though more actively in summer or spring.

The only species from the Southern hemisphere that has, so far as I know, been studied in this respect is the New Zealand *Octochætus multiporus*, of which Beddard (1892) states that the cocoons were gathered in New Zealand in June (that is midwinter) and reached him in London in August (*i.e.*, late summer), and that during the period of seven weeks occupied by transit some worms had hatched out. It is not certain how long such cocoons had been laid before being gathered, nor how much less than seven weeks were occupied in developing.

As to the period occupied by worms in the Northern hemisphere, I can find only four definite statements, but the mean is between three and four weeks.

I append a tabular summary of the result of this search into the literature. I have used the species' names adopted by Michaelsen (1900).

Time of Deposition of Cocoon and Period of Development therein.*

Name of species (Michaelsen).	Author's name of species.	Author.	Cocoon laying.	Period of development.
Helodrilus caliginosus...	*L. communis* ...	Wilson (1889) ...	Most active in spring and summer.	...
H.c. cyaneus	*L. communis*, var. *cyaneus*.	Hoffmeister (1845) ...	Summer and autumn	Usually three weeks.
H.c. trapezoides ...	*L. trapezoides* ...	Kleinenberg (1878)...	Mid-October to mid-June.	...
H.c. trapezoides ...	*L. trapezoides* ...	Vejdovsky (1888–92)	Summer	...
H. longus	*L. terrestris* ...	Wilson (1889) ...	Most active in spring and summer.	...
H. longus	*L. agricola* ...	Kowalevsky (1871)...	Winter (Jan.–Feb.) ...	...
Eisenia fœtida ...	*L. fœtidus* ...	Wilson (1889) ...	Throughout the year: most active in spring and summer.	2–3 weeks in lab. culture.
Criodrilus lacuum ...	*C. lacuum* ...	Collin (1888) ...	June–July	...
Criodrilus lacuum ...	*C. lacuum* ...	Oerley (1887) ...	May, June, July ...	4–5 weeks.
C. lacuum	*C. lacuum* ...	Rosa (1887)	May–June	...
Octochætus multiporus...	*Acanthodrilus multiporus*.	Beddard (1892) ...	Winter	Less than 7 weeks.
Enchytræus albidus ...	*E. mobii* ...	Michaelsen (1886) ...	May	...

The Wider Problem.

Whatever method of dispersal has to be assumed to account for the present distribution of these euryhaline Oligochæta should also account for the somewhat similar facts of distribution met with in various other groups of invertebrate animals.

Chilton (1909, p. 797), in the "Report on the Subantarctic Islands of New Zealand," has given a useful summary of the faunal resemblances that exist between these islands and other Subantarctic islands and lands to the west. Each of the contributors has discussed the distribution of the members of the group in which he was concerned, and from some of these I make a few extracts.

* Bahl (1922, Q.J.M.Sci., vol. lxvi, p. 56) states that the Indian worm, *Pheretima posthuma*, lays its cocoons in abundance during spring and summer (March to June), but very rarely in July and August. The period of development in *P. rodricensis* lasts not more than eight weeks.

Of the terrestrial fauna of Macquarie Island, two slugs have been met with; *Athoracophorus martensi* Suter is very common on the Auckland Islands, and *A. huttoni* Suter occurs also on the Snares Island.

Now this genus is a New Zealand one, so that the species must have been carried in some manner westward, as Cheeseman has found to be the case with some of the Macquarie Island plants.

Can the eggs of these slugs withstand immersion in salt water? Can the animal itself survive in the sea? Is there any current that would convey egg or animal from either island to the west? Could the eggs be carried by birds, either attached to feet or feathers?

Hogg, in describing the Spiders (1909, p. 156), states that the two genera represented on the Macquarie Island, *Myro* and *Rubrius,* are preponderatingly Antarctic. *Myro hamiltoni* was at that time the only spider known from the island, while *Myro kerguelenensis* Cambridge was the only spider obtained from Kerguelen. A third species of the genus occurs at the Cape of Good Hope, while two others live on the Snares, south of New Zealand.

Rainbow (1917) records that *Myro hamiltoni* was found on the hills as well as on the plant, *Cotula plumosa,* which grows on the seashore. Another spider obtained on the island during the Mawson expedition was a single specimen of a small species, *Mynoglenes marrineri* Hogg, measuring only 8 mm. in length. It was originally recorded from under stones on the seashore on Campbell Island (as well as on Enderby Island). The specimen met with on Macquarie Island was found by Mr. Hamilton "on his person" when in the neighbourhood of the sealers' huts.

Another peculiar and minute Arachnid occurring here is *Pœcilphysis kerguelenensis* Cambridge, hitherto only known from that distant island. It is a representative of a separate Order of Arachnida. It was found to be "generally distributed over Macquarie Island," though nothing is said about its living on the seashore by either author.

In regard to the Spiders, Hogg (1909, p. 155) writes: "The supposition of an ancient landlink between South America, Australia, and Southern Africa is more or less of a necessity in order to account for the present distribution of creatures, which it is difficult to believe could have reached their respective habitats by any other means."

Tillyard (1920, p. 10), in his Report on the Insects of this Island, mentions, amongst the lowly Collembola that *Entomobrya mawsoni* Tillyard, which was found under stones at the Penguin Rookery, is closely allied to a species on Tierra del Fuego. He also establishes a new species, *Arrhopalites davidi,* for an insect of which no other species occurs in the Antarctic; but species of the allied genus *Sminthurinus* live at the Crozets, and the genus *Sminthurus* occurs on Kerguelen and Tierra del Fuego.

Leaving, now, the Macquarie Island, the terrestrial fauna, of which is scanty and but little known, we may pass on to consider some examples of the fauna of the other Subantarctic islands near New Zealand.

Amongst the Coleoptera, Broun (1909, p. 78) states that the apterous genus "*Loxomerus*, with five species, is a purely Antarctic form, having *Migadops* from Tierra del Fuego and the Falkland Islands as its nearest congener." It may be noted that the species described from the Auckland and Campbell Islands were found on the seashore. If it be possible that *Notiodrilus* was carried hither by the West Wind Drift, *Loxomerus* may have been conveyed in the same manner. But I cannot imagine that these delicate beetles could withstand immersion in the sea, either as egg, grub, or imago for half a year. How could the grub or imago feed during its transportation ?

Of the Diptera, Lamb writes (1909, p. 130) : "The new genus *Zalucodes*, formed for a wingless limnobiid from the Auckland Islands, seems to come very close to *Zalusa* from the Falkland Islands."

Carpenter (1909, p. 378), in his account of the Collembola, establishes a new species, *Triacanthella alba*, for an insect which occurs on Campbell Island at high-water mark. The genus contains two other species from Tierra del Fuego, while the genus *Triacanthurus*, from Patagonia, "is probably not distinct from it generically."

Chilton, in discussing the Crustacea (1909, p. 602), says : "These terrestrial species, like the fresh-water ones, also show a connection with South America, Falkland Islands and other Subantarctic localities. One species, *Trichoniscus magellanicus* Dana, found in both Auckland and Campbell Islands, is, I think, identical with one found in Tierra del Fuego and Falkland Islands, and is very closely related to *T. verrucosus*, which was recently described by Budde-Lund from the Crozets."

These are "true terrestrial forms, and as the young are hatched out in a pouch below the body of the female, it does not appear likely that they could readily be carried across wide stretches of sea" (p. 799).

On p. 602, he writes : "Another species, *Deto aucklandiæ* Thomson, which occurs on or near the seashore, belongs to a genus of similar distribution, for species are known from New Zealand and the neighbouring islands, from South America, Cape Colony, St. Paul (in the Indian Ocean) and Australia; and the genus is not known from any other locality."

Amongst fresh-water Crustacea we may note *Hyale hirtipalma* Dana, which is found throughout New Zealand and adjacent islands, on the Macquarie Island, and also in South America; and "there can be no doubt that the species described from Kerguelen and South Georgia also belong to this species, and it is widely distributed in the Subantarctic seas" (p. 643).

Idotea lacustris Thomson " is a species widely distributed on Subantarctic shores, and is to be found chiefly in brackish water, but has in more than one place ascended fresh-water streams (as in Campbell Island and at Dunedin), and sometimes to a considerable height." (p. 660).

Littoral Species.

In this connection we may also glance at some of the animals occurring in the Littoral Zone, which would require a coastline for their dissemination, for they are not known from deep water, and even if some of them have pelagic larvæ, it is doubtful, as I will show later, how long these can live and how far they can be carried by currents or winds.

Among littoral Echinoderms I have noted (1909, p. 295) some distributions that are similar to those just given for terrestrial species. *Asterina fimbriata* Perrier, which occurs on the Auckland Island shores, at Campbell Island and on the Snares, has been recorded from McMurdo Bay, and from the Cape of Good Hope ; and, if the synonyms proposed by various authors be accepted, it is also met with on the Crozets, Marion Island, Kerguelen, Tristan d'Acunha, Falkland Islands and the Magellan Strait.

Two Holothurians, *Cucumaria leonina* Semper, and *C. brevidentis* Hutton, taken at the Aucklands also belong to the South American fauna. The former occurs at Cape Horn and at the Falkland Islands, as well as on the coast of the mainland. The latter species occurs in New Zealand and at Juan Fernandez.

It is possible, of course, that these Echinoderms, being possessed of suckers, may attach themselves to floating kelp and thus be transported by the West Wind Drift from South America to their more easterly habitats. But would the kelp float all that time and for all that distance ? Would not the animals be likely to be eaten by fishes during this long transport ?

It is more probable, it seems to me, that they have been distributed by way of a former coastline. That their larvæ are responsible for this extended distribution seems unlikely from the facts noted by me in connection with the Echinoderm fauna of the Kermadec Islands. This fauna is quite different from that of New Zealand, being Indo-Pacific in character. Now it is known that a current sets from New Zealand towards these islands, at any rate that a wind blows more or less constantly in this direction, for logs of the Kauri, which can have come from nowhere else than New Zealand, have been found cast ashore on the Kermadec Islands. Surely, if the larvæ of the New Zealand Echindoerms lived long enough they would also be carried over this comparatively short distance of sea separating New Zealand from these islands. If they do not do so, how much less is it likely that larvæ live sufficiently long to survive a transfer from one Antarctic Island to another over much greater distances ?

In my Report on the Polychæta (1909, p. 237) I wrote: "Most, if not all, of the Polychætes give origin to a pelagic larvæ, which will be affected by the West Wind Drift and so spread round the Antarctic Seas; yet certain resting places would be necessary, one would imagine, for the completion of their development. How long (I asked) can a pelagic larva live before it undergoes metamorphosis? Can it withstand for any period of time the buffeting of the tempestuous southern seas or escape for long the attacks of fishes or other enemies during its floating existence on the surface of the sea? When answers to these questions are available, we shall be better able to utilise these Annelids in any discussions on the previous existence of an Antarctic continent."

Thomson, in his report on the Brachiopoda in this series (1918, p. 38), refers to Blochmann's views as to the distribution of members of that group by means of their larvæ: "The power of distribution of Brachiopods is very limited, and the larvæ are unable to cross the ocean from one coast to another. For most species a gradual migration across the ocean bottom is impossible. Even in the case of the pelagic mouth-bearing larvæ it appears that they do not swim far from the parent, for the genera *Lingula* and *Discina* are not widely distributed."

In my report on the Polychæta of the present expedition (1921), I have enumerated those that were collected on the shores of Macquarie Island, and have given their further distribution (p. 19): "The species are typically Subantarctic in character, and have been recorded either from the southern outliers of New Zealand or from Kerguelen and Falkland Islands. They were all collected in rock pools, or under stones or rocks along the shore."

Some of them are more or less circumpolar, but they have not been found to occur at any great depths. It does not appear that they can have travelled across the sea floor from South America to Macquarie, or *vice versâ*. They, too, seem to point to migration by way of a coastline.

Land Bridges.

(5) The question, then, as to the means by which the Oligochæta arrived at Macquarie Island is part of a much larger question—their distribution on other Subantarctic islands.

If the four previously-considered possibilities of migration or dispersal, viz., polyphyly, floating rafts, carriage by birds, and by drifting seaweeds, if these cannot, so far as one can see, account for the similar distribution of all the various members of different groups of terrestrial animals, though one or other of these methods may be applicable to some of them, one is led to invoke a fifth method—that of land bridges.

The fact that species of *Notiodrilus* have been found on the widely-scattered islands above enumerated stretching round the Antarctic has naturally attracted the

attention of lumbricologists; and not of these only, but also that of other naturalists who interested themselves in the geographical relations of New Zealand and her outlying islands.

It was, I believe, Beddard, who, in 1891 (p. 285), first put forward the view that these various islands and southern lands had been connected by way of an extended Antarctic continent, founding his theory mainly upon the presence of this genus on these far-flung islands. He discussed the subject later in 1893, and again in 1895 (*a* and *b*). Meanwhile Forbes (1893) had published a similar theory to account for the distribution of certain related flightless birds on the Chatham Islands and on the Mascarene Islands, in the Indian Ocean; and he brought forward many examples of other terrestrial animals in support of a tremendously extended land mass joining up the Antarctic continent with New Zealand and Eastern Australia on the one hand, and with Lemuria on the other.

In 1902, in my Address to the Biology Section of the A.A.A.S., at Hobart, and also in my Report on the Oligochæta of the Subantarctic Islands of New Zealand (1909), I accepted Beddard's views and elaborated them. I did not go so far as Forbes had done, and, indeed, argued along different lines, and arrived at a different result, so far as the direction and extent of the land bridges were concerned.

On the other hand, Michaelsen has repeatedly attacked this "Continental Hypothesis" at some length on various occasions (1902, 1905, and 1911), and has done me the honor of quoting somewhat largely from my memoirs, and has strongly criticised many of my arguments.

It is not that he is averse to the idea of previous "land bridges," by which earthworms may have travelled from one part of the world to another; for as Stephenson has recently pointed out (1921, p. 137), he has postulated several such ancient land connections: The Transatlantic bridge, joining the West Indies and Central America to Africa; another linking Africa to India; as well as shorter ones between India and Australia and between India and New Zealand, the last to account for the presence in both lands of the genus *Octochætus*. But he will not accept the necessity for such a land connection in the Antarctic; for he would explain the faunal similarity of these Subantarctic islands by assuming a carriage over-sea, as I have mentioned above.

In spite, however, of the arguments brought forward by him and also by Cheeseman (for the peopling of Macquarie Island by the vascular plants) I am still unable to imagine by what other means these islands have become peopled by these various invertebrates than by some modification of the continental theory, or rather by way of land bridges connecting these islands with the Antarctic continental mass and with the southern continents.

The details of the former views of Beddard and myself must, no doubt, be given up as too little attention was paid to the depths of the sea round and between some

of these islands, of which we now have much more information than at the time we wrote. But I proceed to outline a modification of that earlier opinion.

It is admitted by Cheeseman that the land round the Antarctic pole was formerly of greater extent than at present. Whether that land is now a continent or an archipelago we are still in doubt, for we do not know whether some areas on the margin, like Enderly Land, Coat's Land, etc., are or are not portions of the mainland. This greater extension of the Antarctic mass lasted, according to him, probably till the early Cainozoic epoch.

The soundings between the South Shetlands and South Georgia and between the latter and Tierra del Fuego show that the water is less than 1,000 fathoms and much less in the immediate neighbourhood of these lands. It is suggested that at this early period the sea bottom was above the water, and Cheeseman (1919, p. 53) admits that " along this line in Oligocene, or thereabouts, Antarctica and Fuegia were either connected by a land bridge, which seems most probable, or by a chain of closely-placed islands of considerable size."

At the other end of the Antarctic land it is also admitted that there was probably an extension northwards towards the plateau upon which New Zealand and its southern islands lie, which plateau itself was then dry land, forming Greater New Zealand; and Cheeseman writes (p. 53): "If at the same time there was a northward extension of Antarctica and a similar southern prolongation of the New Zealand area, the distance which at present separates Antarctica from the New Zealand Subantarctic islands might be reduced to a space considerably smaller than what is known to have been crossed by plants and animals in other parts of the world."

But he is strongly of opinion that at no time during the Cainozoic was the deep water (1,000–2,000 fathoms) between Greater New Zealand and Antarctica completely bridged by land.

At any rate a " connection," though not necessarily a continuous land bridge, may have existed as late as the earliest Cainozoic epoch between Fuegia and New Zealand.

Turning now to the scattered islands between South Georgia and the islands south of New Zealand. Eastwards of South Georgia is a tract of ocean of a depth ranging from 1,500–2,000 fathoms extending past Bouvet Island to the plateau on which are set Marion and Prince Edward Islands, and further eastwards, the Crozet Islands; this plateau has above it a depth of water not exceeding 1,000 fathoms, and much less in some parts.

It may even be the case also—for our knowledge of all this region is not very exhaustive—that the depth of the intervening sea is not uniformly so great as 1,500 fathoms, and that there may be a submerged ridge linking Bouvet Island to this plateau on the east and to South Georgia on the west, so that an elevation at some earlier date would have placed these islands in continuity.

Are we justified by any geological facts in supposing that this could have been raised up to form a long narrow arm of land so as to link the Crozets with Fuegia?

MAP SHOWING THE GENERAL DIRECTION OF THE ASSUMED LAND BRIDGES BELOW 2,000 FATHOMS, THOUGH NOT NECESSARILY THEIR EXTENT.
(Compiled from J. A. Thomson's Map.)

NOTE.—Land in left, white; Sea is shaded.

A.—Auckland Island.	Gr.—Graham's Land.
Ant.—Antipodes Island.	Mac.—Macquarie Island.
C.—Campbell Island.	S.G.—South Georgia.
F.—Falkland Islands.	S.O.—South Orkneys.
Fu.—Tierra del Fuego.	S.S.—South Shetland Is.

Judging from the remarks by Thomson as to the Brachiopoda of Marion Island and South Africa, it appears that he does contemplate the possibility of land connection between them in Cainozoic times at a date earlier than the Miocene (p. 48).

As the depths between these two places is shown on the map to be approximately the same as that separating Crozets and Bouvet and South Georgia, what reason is there for forbidding us to assume such a land bridge here also?

There remains Kerguelen, which is likewise separated from the Antarctic by a depth of 1,500-2,000 fathoms; and if the former bridge be conceded, then an arm from the continent extending in a northerly direction may have included this island also.

Thomson (p. 57) states that Kerguelen appears to have been separated from all other lands since the Miocene. Does this not imply that it may have been linked to the Antarctic continent or other land area at an earlier date in the Cainozoic?

We come now to Macquarie Island. When we remember that it is a volcanic mountain rising from a depth of 2,000 fathoms, we meet with difficulties in supposing that it could have been connected, at any rate during the Cainozoic epoch, with any neighbouring land, such as the New Zealand plateau. One school of geologists, represented by Mathews, holds that such a depth at once negatives such an assumption. But another school, exemplified by Schuchert* (1916), does not seem to be deterred by even such a depth as this. In discussing (p. 103) the ancient Gondwana Land of the Mesozoic epoch, he states that it is a fallacy to assume that the now sunken portions of the Eastern Gondwana land were raised out of the depths of the Indian Ocean after it had become very deep. The ocean began to deepen during the sinking of the continent in early Mesozoic times.

I gather, however, that many geologists, even of this school, would limit these large movements to the Mesozoic or at least to the very earliest part of the Cainozoic. However, in referring to New Zealand (p. 96) Schuchert believes that there was continuous subsidence from later Eocene into Pliocene times, when as much as 9,000 feet (*i.e.*, 1,500 fathoms) of marine sediment had been laid down along its eastern sinking margin. Later, in Pliocene, there was a marked vertical uplift, probably as much as 4,500 feet and possibly 6,000 feet. "In the Pliocene all of eastern Australia was vertically elevated and blockfaulted between 1,500 and 7,300 feet above the level of the sea. In compensation for this elevation, the Tasman Sea sank, there being now great depths close to the continent, which in one place goes down to 18,500 feet" (that is, more than 3,000 fathoms).

I gather, therefore, that, at any rate, some geologists acknowledge that during the Cainozoic epoch a considerable amount of up and down movement has taken place; and it seems not impossible that Macquarie Island may have shared in them to the extent that it became connected, and later lost this connection, with some or other of its neighbours. Indeed, Thomson (1918) when discussing the origin and distribution of the Brachiopoda in these circumpolar seas, writes (p. 55): "The absence of (*Magellania* s.str.) in New Zealand and its presence in the Macquarie Islands seems to point to a former land bridge connecting Tasmania with Antarctica through the Macquarie Islands."

Now, since these two islands are at present separated by a depth of seas as great as that which separates Macquarie Island from Antarctica or from Auckland Island, may we not assume, from the distribution of other groups of animals, that such a land bridge also existed here? If geology allows the former bridge, will it deny the latter?

On p. 59, Thomson states—"By a consideration of the Brachiopod fauna then it seems necessary to make the following assumptions: By connection is implied not

* I have to thank my colleague, Dr. W. N. Benson, for drawing my attention to this and other papers on the subject.

necessarily land connections but at least relatively shallow submarine ridges or chains of islands at no great distance from one another." Such chains of islands would, I believe, suffice for our immediate purpose; for then birds might distribute the cocoons of these Oligochætes, while the pelagic larvæ of some of the littoral animals might be able to survive for so short a time necessary to pass across the intervening seas.

Nevertheless, if the depths of the seas would allow the uprising of the floor to form such chains of islands, it is within the limits of possibility that it would rise a little further and join those islands together, temporarily, to form a land bridge. For the Brachiopods, such a bridge is not needed; all that is demanded by that group is shallow water, but for the insects, spiders, and probably the Oligochætes, a land bridge does seem necessary.

Further on, Thomson writes—"Connection between Australia, the New Zealand region, Macquarie Island, Kerguelen Island, the Antarctic, and South America, must have occurred in the early Tertiary, but New Zealand was not connected at the same time with both Australia and the Antarctic. The connections between New Zealand, the Antarctic and South America may have existed from an earlier date."

And again,—"The circum-Pacific southern connections were all broken, much as at present, by the Miocene, and since that date there have been no renewed connections between the southern continents and island districts, except possibly between South America and the Antarctic and adjacent islands."

Thomson is a geologist, and yet is impressed by the biological problem of distribution, and fearlessly asserts that the kind of connection that Beddard and I have previously assumed must have existed to account for the distribution of the shallow-water Brachiopods.

The Date of the Origin of Oligochæta.

The date of the origin of the group of Oligochæta necessarily has a bearing on their mode of distribution; since if there has been a larger extent of land in these southern latitudes in the late Mesozoic and early Cainozoic, an opportunity for migration would be available, which would not be the case if the group had not evolved, as Stephenson suggests (1921, p. 133) till late Tertiary times.

He regards the Oligochæta as a very modern group, relying on the fact that various genera of earthworms to-day are linked together by intermediate genera, so that the phylogeny can be readily traced out in such a family as the Megascolecidæ.

But are not birds in much the same position? Are not genera and families linked together so much that the classification of the class is difficult? Yet we know they are not a modern group.

The common association of earthworms with Dicotyledonous plants suggested to me a few years back that possibly they are a recent group. But the examination of the contents of the intestine of some of our native species which live in forests showed

that at the present day they do not feed exclusively on the leaves or débris of these higher vascular plants, for I found the sporangia of ferns, as well as the characteristic tracheids of their vascular bundles, quite abundantly in their intestines. I was led, therefore, to think that even before dicotyledons existed there would have been sufficient "mould" formed from rotting ferns, &c., to provide food for the worms. And I should put their origin somewhere in the early Mesozoic epoch.

It is true that *Notiodrilus* is to-day regarded as the most archaic amongst the Megascolecidæ, from which a number of other genera can apparently be derived, as both Michaelsen and Stephenson have shown. But it seems probable that this genus was preceded in time by some still more primitive form, and that until dicotyledonous plants became abundant and varied, as they did in later Mesozoic and early Cainozoic times, there was less variation amongst these worms, since there would be less variation in habitats. When the variation in the plants became greater and new plant associations became established, the evolution of the earthworms would become more rapid than in the Mesozoic; hence the evolution of new genera, which would form a series, linked on to *Notiodrilus*. No doubt in that respect the group is new, in that there is now, and has been since the commencement of the Cainozoic, far more opportunity for the evolution of new types.

Down in these southern latitudes, where conditions of life and habitat are to-day similar all round the Antarctic, we find but few different genera. Indeed, there is, as Michaelsen has shown, a merging of such unlike types as *Microscolex* with the more primitive *Notiodrilus*. As we pass northwards, along the continents, where new and varied plant associations and a variety of habitats occur, we meet with increasingly differentiated types.

Glaciation of the Subantarctic Lands.

Even if it be granted that at some period in the very early Cainozoic epoch there was a greater extension of land surface, allowing for the migration of these earthworms and of sundry other invertebrate animals, we have evidence that each of these islands concerned was covered with an ice-sheet during part of that period, which would presumably have destroyed all or almost all of the original plants, allowing only a few grasses to survive (Cheeseman). It would naturally have destroyed the animals.

An important question now arises: Did this ice-sheet exist over these lands before or after the disruption of the presumed land bridges?

We know from the discovery of fossil leaves at Graham's Land that at or immediately before the beginning of the Cainozoic Antarctica enjoyed a genial climate, and so doubtless did the assumed northern extensions. The ice-sheet appears to have gradually extended further northward, wiped out the primitive fauna and flora, but later retreated, so that the land now represented by the islands became fit for repeopling.

If the ice-sheet disappeared before the actual disruption of the land connections, before they were separated into islands, then a shore-line would have existed, along which both littoral and terrestrial animals would have been able to travel. The spiders and insects of the Macquarie Island appear to be of South American origin and to have migrated eastwards to their present habitat, as also did most of the plants. Then, after the repeopling of this land surface the various connecting land bridges slowly sank into the sea, leaving the islands much as we know them to-day. Thomson, as we have seen, would place this disruption not later than the Miocene. These islands would thus have received representative genera, which would have developed into distinct species owing to isolation.

That these events took place not so very long ago geologically is indicated by the close affinity or even identity of species occuring in these widely-separated areas.

If, therefore, the ice-sheet melted while the land bridges were still intact, we can account for the existence of these forms on Macquarie and other islands.

Perhaps it is worth noting in this relation that we know that some Oligochætes can withstand freezing and can live embedded in ice, as has been described by Moore (1899) in his account of a "Snow-inhabiting Enchytraeid," which is widely distributed over the surface of the snow-field of the glacier of Malaspina on Mount Elias, in Alaska.

He refers to the records of other species of worms, not only of those belonging to this family, but also of earthworms, being found frozen and recovering their vitality on being thawed out. Since that paper was published, Piguet (1919) has described the occurrence of *Tubifex ferox* and of *Stylodrilus heringianus* in Lake Tjaura-jauratj, on the mountain of Sarek, which lies within the Arctic circle. This lake is filled with ice during the greater part of the year, usually thawing at the end of July. It is not to be supposed that these two Oligochætes would live in the ice during these months, but at any rate their cocoons with eggs must be able to survive this extremely low temperature for many months.

It is, thus, within the bounds of possibility that the eggs of some of these Subantarctic Oligochætes may have survived on these islands during the period of their glaciation, though our knowledge of the length of time for which the worms can withstand freezing and remain dormant in the ice is necessarily insufficient to permit us to state that they are able to do so. But these observations do render it possible that in earth under the ice-sheet, or near its edge, where they would get the benefit of the short summer's sun, that the eggs in the cocoons, and even perhaps the worms themselves, might be able to live for many years. For if the eggs can remain alive in such conditions as Piguet found to obtain on Mount Sarek for the greater part of the year, there seems to be no logical reason against their remaining in a dormant condition for two years, or for two hundred years, or many more.

It is naturally impossible to conduct experiments over any comparable period of time as would be required to test the above suggestion, but the few experiments

made by Schmidt (1918) on "Anabiosis of Earthworms," their loss of weight on drying, their revival after some days, especially noticeable at an ice temperature, is in this connection of much interest.

An objection has naturally been put forward in regard to the assumption of a former land connection between Australia and South America, and between the latter and New Zealand, to the effect that had this connection, which is admitted to have been in existence in the late Mesozoic, continued into the Eocene, mammals would have probably entered these eastern regions. But if such eastward extensions were still in existence at the time the earliest mammals lived on South America, and the ice-sheet caught them while on the Antarctic or other portions of the land surface, the absence of all mammals from New Zealand and of placentals from Australia would receive an explanation.

SUMMARY.

We have thus a geologist, from his study of the present and past distribution of a marine group, and a zoologist, from a study of the present distribution of spiders both asserting the "necessity" for such a land connection during early Cainozoic epoch. Although one must agree with Stephenson when he says that one ought not to assume such vast changes in level of the sea bottom until one has exhausted all other possible and probable explanations of dispersal, yet I think that the problem presented by these Oligochætes, Insects, Spiders, and terrestrial Crustacea renders it difficult, if not impossible, to imagine any other method of dispersal that will explain all the facts presented by these Subantarctic islands.

Macquarie Island, then, seems to have received the ancestors of its Oligochætes from the distant islands of Kerguelen or Crozet by way of a series of land bridges connecting them indirectly but mutually with the Antarctic continent during the early Cainozoic epoch.

It is not necessary to assume that these various land connections were contemporary with one another; they may have been successive or even alternating; nor is it necessary to assume that they, or all of them, lasted for any very great length of time; there were, no doubt, periods of uprising and depression going on over this area.

The most recent, and perhaps the one that lasted longest, was doubtless the connection between South America and Graham's Land, for here the depth is comparatively shallow. But in what order the other bridges appeared and disappeared, or how long any of them remained above sea, I do not know that we have any evidence for making a guess.

Whether Macquarie Island was ever directly connected with this Antarctic land mass or archipelago is very uncertain, unless, as Dr. Thomson has suggested, it was by way of Tasmania.*

*We do not, however, know of the occurrence of *Notiodrilus* or of any of these Subantarctic Oligochæta on the shore of Tasmania; but, as a matter of fact, we know practically nothing of the Oligochæta of the island.

ADDENDUM.

In an article in "Discovery" (1922, vol. iii, p. 114), Wegener gives a brief account of his work on "The Origin of Continents and Oceans," in which he introduces what appears to be a new and revolutionary conception as to former land connections, which involves not the changes in level of the sea floor, but the gradual movement of the continents themselves. He writes—"The continents in past ages have drifted horizontally over the surface of the earth, and are still in motion at the present time." According to this "displacement" theory, Antarctica, India, Australasia, were during Palæozoic epoch in immediate contact with South Africa and with the land then representing South America. During the successive geological epochs, after the shifting apart of these continents in the region of the equator, Antarctica, Australasia, and South America still remained in continuity at the Eocene period.

Such a conception would exactly meet the requirements of the distributional facts discussed above.

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INDEX.

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GEPHYREA INERMIA.

BY

W. B. BENHAM, M.A. (OXON.), D.SC. (LOND.), F.R.S., F.N.Z.INST.

WITH ONE PLATE.

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CONTENTS.

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By W. B. Benham, M.A. (Oxon.), D.Sc. (Lond.), F.R.S., F.N.Z.Inst., Professor of Biology, University of Otago, New Zealand.

With Plate 11.

INTRODUCTION.

The collection of Unarmed Gephyrea contains five species, viz. :—*Priapulus caudatus*, var. *tuberculato-spinosus* Baird; *Phascolosoma margaritaceum*, var. *capsiforme* Baird; *Phascolosoma eremita*, var. *australe* nov.; *Phascolosoma mawsoni* sp. nov.; and *Physcosoma scolops* Selenka and Man.

The last species came not from the Antarctic Sea, but from the neighbourhood of Tasmania—a new record for it, although it is common in the sea round New Zealand, which is its most southerly habitat. As I have mentioned in my Report on the Polychæta, there are some other resemblances between the faunæ of these two areas.

The two first species on the list are well-known Antarctic and Subantarctic forms, and have been recorded by most of the recent expeditions to these southern seas. I have discussed below the question as to whether Michaelsen's three species of *Phascolosoma*, from South Georgia, are or are not to be included in the variety *capsiforme*, and the conclusion I have come to is in the negative.

The discovery of a variety of the arctic species *P. eremita* adds another instance to the list of " bipolar " species, which serves to strengthen, if need be, Théel's views as to bipolarity discussed in his memoir on the Gephyrea of the Swedish Antarctic expedition.

I have been so presumptuous as to analyse the characters usually regarded as diagnostic of species of *Phascolosoma*, but I recognise that a much wider field for comparison is needed before one can come to a final conclusion on the subject. The characters that are available are few in number, and many of them are, I believe, liable to a considerable degree of variation, as a consequence of the contractility of the animals. At the same time the structure of the skin, on which reliance has been placed in recent years, is not always available on account of imperfect preservation of the material and the lack in many cases of careful drawings of the papillæ.

ORDER PRIAPULOIDEA.

PRIAPULUS *Lamarck.*

PRIAPULUS CAUDATUS *var.* TUBERCULATO-SPINOSUS *Baird.*

P. caudatus Lamarck (1801), p. 467.
P. tuberculato-spinosus Baird (1868), p. 106, pl. XI, fig. 2.
P. tuberculato-spinosus de Guerne (1888), p. 9.
P. caudatus var. *antarcticus* Michaelsen (1889), p. 10, fig. 3.
P. caudatus var. *antarcticus* Fischer (1896), p. 6 (1914A), p. 22, fig. 12.
P. caudatus Shipley (1902), p. 284.
P. caudatus forma *tuberculato-spinosus* Théel (1911), p. 18, pl. I, figs. 1–12.
P. caudatus Benham (1916).

Three individuals were included in the collection forwarded to me. Two of these were obtained at Commonwealth Bay in 3 fathoms of water, and one had been removed from the stomach of the fish *Zanclorhynchus spinifer* Gunther, caught near Macquarie Island (Waite). This is a new habitat for the Priapulid.

The specimen is soft and appears to show signs of the commencement of digestion. It is rather larger than the one from Commonwealth Bay, and shows the branching of the gills.

Of the Commonwealth Bay specimens, the larger has a total length of 35 mm., of which the introvert occupies 8 mm. and the caudal appendages 6 mm. So that the body itself is 21 mm. in length. It is 7·5 mm. in diameter, while the introvert is 10 mm.

The smaller individual measures only 10 mm. by 3 mm. The larger is a very pale brown, or perhaps dirty white, in colour with a slight greenish tinge. The gills are much contracted, so as to be short rounded lobes; some are distended into oval bladders; all are crowded together, so as to conceal the tail.

The preanal ring of papillæ presents but a slight "gap," much less noticeable than that shown in Michaelsen's figure, which may perhaps be due to the fact that this specimen is strongly contracted. In the smaller specimen the "gap," indeed, is not recognisable. But, as Théel has shown (1911), the presence of this gap has not the value that Michaelsen assumed, as the northern form also presents it. The real distinction between the typical species and this southern variety lies in the form of the teeth at the entrance to the introvert, which are so admirably illustrated by Théel in the above memoir, in which there is a full discussion on the differences.

Localities.—

Commonwealth Bay, Boat Harbour, 3 fathoms (two).
Macquarie Island (stomach of fish).

Distribution.—South Georgia (Mich.); Tierra del Fuego (Fischer); Cape Adare (Shipley); St. of Magellan, Falkland Islands (Baird, de Guerne) Graham Land Region (Théel).

ORDER SIPUNCULOIDEA.

Family SIPUNLULIDÆ.

PHASCOLOSOMA *Leuckart.*

PHASCOLOSOMA MARGARITACEUM, *var.* CAPSIFORME *Baird.*

(Plate 11, figs. 1, 2.)

P. margaritaceum Sars (1851), p. 25, *cf.* Selenka (1883), p. 25, for synonyms.

P. capsiforme Baird (1868), p. 83, pl. IX, fig. 3.

P. margaritaceum, var. *capsiforme* Fischer (1896), p. 3 (1914 A), p. 10.

P. capsiforme Shipley (1902), p. 285.

P. margaritaceum Théel (1911), p. 26.

Five individuals were contained in the collection, varying in length from 160 mm. to 28 mm.

The remarks that follow apply to the largest.

The skin is a dirty grey, rather silvery, tending to a pale greyish-brown at the hinder end and on various parts of the body, which suggests that the epidermis had been rubbed off from parts. To the naked eye the skin looks smooth except at the hinder end, which is rather rough owing to circular furrows. One specimen obtained from Station 1 has a white silvery surface.

In the two smallest individuals the body wall is sufficiently translucent to allow the densely-coiled gut to be seen within.

Of the five specimens the majority have the hinder end rounded, but one of them, the next in size to that measured (below), is produced into a point exactly like Baird's figure of *P. capsiforme.* The condition, then, of the hinder end seems to be due to the state of contraction of the muscles of the body wall.

Under a hand lens the whole skin is seen to be traversed by fine, closely-set furrows, running round the body, and in some specimens with delicate longitudinal, undulating, and anastomising furrows. In the islands between these are minute scattered transparent dots, which are irregularly arranged and widely spaced. These, when studied under the microscope, are found to be the openings of glands, seated on low, rounded papillæ of a pale yellowish colour, and the sides are tesselated (figs. 1, 2). In many cases the gland aperture is flush with the surface of the skin, though whether this is caused by the maceration of the epidermis I am unable to state.

In the various mounts I noted one exceptional papilla, which has a skittle shape: that is, it is constricted at the base. On the introvert and towards the hinder end of the body the papillæ are more densely arranged, and in some cases have the form of a mammilla, the aperture being seated on a teat-like prominence.

The appearance of the skin agrees with that figured by Selenka for the variety (pl. IV, figs. 38, 39) and with that of the species (fig. 37).

The tentacles are in three or four rows of about ten in each row. As I had to cut open the introvert in order to study them it was impossible to ascertain whether they would have the appearance presented by the figure given by Théel for this form (pl. V, fig. 67), but altogether I estimate that there are thirty tentacles.

Internally, too, the worm agrees with Théel's figure (pl. V, fig. 68), though the number of intestinal coils varies with the length of the animal. Thus, in the largest specimen I counted twenty-eight coils wrapping round a similar number of internal upwardly-directed coils, the whole forming a close spiral measuring 20 mm. across. In a smaller specimen (from Station 1), which is 48 mm., including the introvert, the number of coils is twenty-four, while in the individual D, which is only 28 mm. in length, the number of coils is sixteen. The two dorsal retractor muscles are attached to the body wall at a point 8 mm. behind the anus; the ventrals arise 40 mm. behind that aperture.

There are no contractile tubules on the œsophageal vessel.

Localities—

Station 1, 350–400 fathoms (22 xii 13) (one).

Station 2, 318 fathoms (28 xii 13) (four).

Distribution.—This variety has been obtained from Magellan Strait, Tierra del Fuego, Falkland Islands, Picton Island, Cape Adare, Graham Region.

Remarks.—Five closely-allied species have been obtained from the Antarctic and Subantarctic seas—namely, *P. margaritaceum*, var. *capsiforme* Baird, from the Falkland Islands; *P. fuscum* Michaelsen, and *P. antarcticum* Mich., and *P. georgianum* Mich., from South Georgia; *P. socium* Lanchester, from Cape Adare.

P. georgianum appears to be distinguished from Michaelsen's other species by its short introvert, and its smooth translucent body wall with large dark papillæ on the skin.

The two other species from South Georgia are so closely related that even Michaelsen himself (1889) thought it not unlikely that they are in reality varieties or sub-species of *P. margaritaceum* (as also probably is *P. capsiforme* Baird).

Although a study of Michaelsen's account of these two species makes it difficult to separate them, Herubel was able to do so, for he records specimens of each from Port Charcot, though the differences on which he relies are very slight.

Fischer (1896, 1914) has recognised that *P. capsiforme* is but a variety or sub-species of the northern *P. margaritaceum*, and would even place as varieties of this species the three South Georgian forms of Michaelsen.

Lanchester (1908), in his analysis of the form he calls *P. socium*, seems also to suggest the identity of, at any rate, *P. fuscum* and *P. antarcticum*, and points out that *P. socium* presents some internal features which resemble the one, and others that recall the other of these two forms.

Théel (1911) has gone even further and places all these forms, not as varieties, but as members of the northern species.

Having discussed the characters usually employed in distinguishing species in this genus, Lanchester concludes that they are of "a very vague and unsatisfactory kind," and relies almost wholly on the character of the skin. *P. socium* agrees more nearly with *P. margaritaceum* in this feature than with the South Georgian forms, in which the papillæ are longer. Nevertheless, he separates *P. socium* from *P. margaritaceum* on account of the proportion of introvert to body length; for instead of having an introvert about half the length of the body, as in the northern species, it is in the Cape Adare form, "not much shorter than the length of the body."

My studies of the specimens obtained by the s.s. "Aurora" seems to me to emphasise the unsatisfactoriness of the usual diagnostic features.

When we bear in mind the nature of the body wall and the great contractility of the whole worm, it certainly appears that we cannot put much reliance on proportions of length of the various regions or upon such features as the exact position of the origin of the retractor muscles of the introvert: or these characters must be used in association with other features.

The Sipunculids, as is well known, inhabit the mud and sand of the sea bottom, and as they burrow therein* must be constantly altering the form of the body, pushing forwards the introvert and again retracting it as it moves along through the mud.

When the introvert is fully extended, the circular muscles of the body wall as well as those of the introvert must be in a state of contraction, in order to force the cœlomic fluid into this introvert and so distend it. But the longitudinal muscles may also contract at the same time or immediately after, shortening the hinder part of the body, as the animal progresses forwards, pulling it after the introvert. Now it is conceivable that the muscles of the body and those of the introvert are not contracted to an equal degree

*Andrews, Studies, Johns Hopkins Univ., 1887–1890, vol. iv, p. 389.

for we find in some specimens with the introvert fully extended or fully withdrawn that the hinder end is sometimes rounded and sometimes pointed; in the former case the longitudinal muscles are, of course, in a state of contraction, while in the latter they are relaxed.

It follows, therefore, that the proportion of length of introvert to length of body is a variable, depending on the state of the worm at death, even if the introvert be fully extended, as some of the measurements given below will indicate, as do also those given by Lanchester.

In measuring the length of introvert I have taken the anus as its base; Lanchester and Michaelsen use the nephridiopores, whereas Southern uses the anus, and it appears that Selenka takes this point also. I find the anus more useful, since the nephridiopores are not so easily detected, and, anyhow, they are only a millimetre or so in front of that aperture, so that the difference cannot be material.

The only work in which a definite statement is made as to the extent of the introvert as a morphological feature is Delage and Hérouard's "Zoologie Concrète" (tome V, p. 12), where the anus is taken as marking the limit between the two regions.

Now, although the worms above described are ascribed to the variety *capsiforme*, yet a comparison of measurements shows that the proportion of length of introvert to length of body differs from that given for the species and for this variety by various authors.

The dimensions of the five worms are given below. The length is taken along the mid-dorsal line and not along the outer curve, if the worm is curved, as so often happens.

The largest specimen has the introvert only partially extended, and this is curved over to the right side and the apex bent backward. The total length along this outer curve is 200 mm., but along the mid-dorsal line it is 160 mm. The greatest diameter of the body is 25 mm., and that of the introvert 5 mm. The anus is situated 80 mm. from the hinder end on a brown papilla. Anteriorly to the anus the diameter of the body begins to decrease, and this slenderer region is 80 mm. in length. Its oral end is, however, withdrawn, and on slitting open the introvert it is seen that this internal portion measures 10 mm. and is much contracted, so that during life it would no doubt be much longer.

Only one individual (from Station 1) has the introvert fully extended so as to show the tentacles; the total length is 48 mm. and the anus is just halfway along this length, so that the introvert is equal to the body length.

DIMENSIONS of *P. margaritaceum*, var. *capsiforme*, from Commonwealth Bay.

Specimen.	Body.		Introvert.	
	Length.	Width.	Length.	Width.
A	80	25	80	5
B	57	20	80	...
C	24	10	24	4
D	11	...	17	...
E	25	...	35	...

NOTE.

In C, from Station 1, the introvert is fully extended; in the rest it is more or less invaginated, and the length is that seen externally.

In B the introvert has 20 mm. invaginated.

In the typical *P. margaritaceum* and in the variety *capsiforme* the introvert is stated to be about half the length of the body. Selenka gives for the species the numbers 100 mm. and 50 mm. respectively, and for *P. capsiforme* 26 mm. and 15 mm. Fischer states that the introvert is slightly longer than the body. Lanchester, who measured two specimens of *P. capsiforme*, finds in one of them, in which the introvert is retracted, that when measured "it is markedly less than half the body length," but estimates that when fully extended it would be "about half the length" of the body. In a second specimen, however, he finds the introvert "approximately equal in length to the body."

As will be seen in the above table of the forms from Commonwealth Bay, in the larger individuals in which the introvert is partially withdrawn it exceeds the length of the body, as it does also in smaller specimens. In the single individual with the introvert extended, its length is equal to that of the body.

On comparing these worms with those described by Michaelsen we find approximately the same proportions; it is as long or rather longer than the body, except in *P. georgianum*, where it is short, retracted, or "may in complete extension attain half the length of the body."

With *P. socium*, too, it agrees, in that the introvert is longer than the body; but from this, as from Michaelsen's species, it differs in the character of the skin papillæ, which in *P. socium* have a diameter from half to two-thirds the height, whereas in the Commonwealth Bay worms the width is greater than the height.

So far, then, as external features are concerned, we have to decide whether more importance is to be placed on proportions of body or on the form and size of papillæ. As has already been pointed out, the former necessarily vary according to the degree of contraction of the muscles of the body wall, which may perhaps be so great as to discount the value of these proportional measurements.

What other characters, then, are of use in distinguishing species? The shape, and especially the dimensions, of the nephridia seem to be useless; they, too, are highly contractile, and their shape and length may vary on the two sides of the same worm. The number of intestinal coils varies apparently with the size; that is, with the age of the individual. I have noted that in three specimens differing in length the number of coils is proportional to that length, or rather, is less in the smaller individuals than in the larger. Lanchester found similar differences in his specimens of *P. socium*.

There remains, then, the position of the origin of the retractor muscles of the introvert in relation to the anus or to the nephridiopores. For their distance from the hinder end of the body is more likely to be affected by the contraction of this region of the body and to a greater degree than the shorter distance from the anus.

In the present specimens the ventral retractors arise at or behind the middle of the body length; the origin of the dorsal retractors is within the first quarter of that length.

In order to be able to compare the positions of these points in the different varieties above enumerated, it is necessary to reduce the body length to a common unit, say 100, and to state the position of these origins in percentages of that length.

The only tabulated series of measurements that I have met with is that given by Lanchester for *P. socium*; he takes the distance from the nephridiopores, and it is necessary to deduct from his numbers the distance of these from the anus in order to bring them into line with the measurements given above.

I have excluded from my comparison the specimens marked by him E and F, which differ in other features from the rest of his specimens and about which it is evident he was in some doubt as to their identity. I have reduced Lanchester's numbers to percentages of body length, and plotted them on paper, with the result that the dorsal retractors in all these specimens of *P. socium* originate within the anterior third of the body as they do in my specimens; while the ventral retractors arise in the middle third, but this

point in all lies in front of the 50 per cent. mark. I used the same method in dealing with the specimens from Commonwealth Bay, and find that the ventral retractors in the three individuals measured lie at or behind this halfway mark. It would, of course, be necessary to make measurements of a greater number of specimens in order to make sure that this difference is a real one before one can make use of it as a specific or varietal character.

It appears that in all these southern varieties the dorsals arise in the anterior third, and the ventral retractors approximately in the middle third of the body length. But the mode of statement followed by Michaelsen and by Fischer in reference to these points makes it difficult to tabulate their exact position.

It seems, at any rate, impossible to use these positions for specific or varietal purposes, and we are driven back to the skin, its naked eye appearance and its microscopic structure.

Using this criterion the present specimens agree with *P. margaritaceum*, var. *capsiforme*.

In general appearance to the naked eye, *P. socium* seems to agree with this, for Lanchester states that in it the skin is "smooth, thin, semi-transparent, with minute papillæ, barely visible under a hand lens"; and *P. georgianum* also has a smooth, shining, silvery skin, sufficiently translucent for the internal organs to be seen dimly through it, as is the case with the smallest of my specimens. But the other two species from South Georgia have dark coloured and opaque body walls.

In regard to the form and proportions of the skin papillæ there seem to me considerable differences, for whereas in Michaelsen's species and in *P. socium* the papillæ are pear-shaped, constricted at the base, and have a breadth much less than the height, namely, from one-fourth to one-half, in the Commonwealth Bay forms they are low, rounded, only slightly prominent, with a width greater than, or at least only equal to, the height.

For this reason, therefore, I have been unable to accept Théel's opinion that all of them are to be included in the northern species.

Phascolosoma mawsoni, *sp. nov.*

(Plate 11, figs. 3–11.)

More than fifty small Phascolosomids present characters which appear to warrant the formation of a new species. It is true that the recent literature at my disposal is

rather limited, and the only Memoir dealing with Antarctic Sipunculids is Théel's Report of the Swedish Expedition. It does not fit into any of the species therein described, nor with those of Michaelsen.

I therefore take the opportunity of associating with it the name of Sir Douglas Mawson.

The general appearance of this species is very different from the preceding, both in its creamy white colour, in the texture of the skin, and in the general form of body. Although these differences are rather difficult to put into writing, yet when the two species are seen side by side the distinctness is quite evident.

A characteristic feature is the presence at the rounded hinder end of the body of a definite cone, low and rounded (fig. 3). In the extended condition of the animal this is prominent, but when the animal is more or less contracted, this cone, while still retaining its definite form, becomes sunk into a fossa, shallow or deep according to the degree of contraction (figs. 4, 5). Sometimes the cone is sunk to such a depth that it is invisible from the side.

It is a feature that is not unusual in the genus *Dendrostoma*, if one may judge from the figures illustrating the Memoirs of Selenka and of Ikeda, though it does not appear in such a definite form in any species of *Phascolosoma*.

The tentacular crown, however, has the usual arrangement of the latter genus. There is a cushion on the dorsal surface, grooved lengthwise so as to appear double, and around the mouth, which lies excentrically, is a circle of thirty short tentacles: these are connected at their bases in couples, one couple is median ventral, the rest lateral; actually there are fifteen such couples (figs. 9, 10).

In a series of transverse sections through the crown I was unable to detect any cerebral canal. There certainly is nothing like that figured by Herubel for *P. charcoti* (1908, p. 5, figs. 5, 6).

The animal attains a length of 42 mm., which is the largest in the collection. This figure includes the fully extended introvert. The shortest individual is only 8 mm. in length.

A specimen measured gives the following figures:—Total length, 39 mm., of which the introvert occupies 20 mm., taking the anus as its point of origin. The diameter of the body is 5 mm., while that of the introvert is only 2 mm. Thus the introvert is rather longer than the body, and is distinctly marked off from it by its sudden decrease in diameter.

In the following table I give measurements of other individuals in which the introvert is fully extended, and it will be seen that the amount of contraction of the body is very unequal, especially at the hinder end, hence the comparative uselessness of these proportions as a specific character.

DIMENSIONS of *P. mawsoni*, in which the introvert is fully extended.

Specimen.	Total Length.	Body.		Introvert.	
		Length.	Diameter.	Length.	Diameter.
	mm.				
A	42	20	6	22	3
B	42	12	6	30	4
C	32	10	4	22	2
D	29	13	4	16	1·25
E	24	10	4·5	14	2
F	23	7	3·5	16	2

NOTES.

In C the hinder end is contracted, so that the terminal cone is surrounded by a fossa, but is visible from the side.

B is more contracted, so that the terminal cone is not visible from the side.

In E the introvert is curved, but the specimen seems to be more uniformly contracted than the others. The hinder end is not at all withdrawn.

F has the hinder end much contracted.

The skin is creamy white in colour, opaque and rather rough. The roughness is due partly to the circularly disposed but discontinuous wide furrows and narrow ridges, and partly to the more or less widely and irregularly scattered papillæ, which are nearly white (fig. 6). These have the appearance, under a hand lens, of short columns, and are especially conspicuous when they are seen in profile. Though widely spaced on the body generally, they become more crowded at the hinder end, and also on the introvert, where they become more numerous as the tentacles are approached.

Viewed under the microscope (glycerine preparation), the papillæ over the mid-body are yellower than the surrounding skin; they are skittle-shaped, that is, ovoid and slightly constricted at the base (fig. 7). There is no pigment other than the yellowish secretion from the gland cells, which latter have a tesselated arrangement.

The length of a papilla is about one and a third times its breadth. Neither in fully extended nor in contracted specimens are any longitudinal furrows or ridges visible.

There are no hooks on the skin.

Internal anatomy (fig. 11).—The intestine is rather loosely coiled, the upward and downward limbs of the coils are not so regularly arranged as in *P. margaritaceum*. I counted twelve double coils in one individual, which was fully extended; while in a contracted one of about the same size there are nineteen double coils, and these are more regularly disposed, the up and down coils alternating.

The intestine is free posteriorly, the spindle muscle is very delicate, and I was unable to detect its anterior attachment. The anterior coils of the intestine are held

to the body wall by two, or perhaps three, very slender bridles. The rectum is suspended by a broad sheet of tissue, stretching on each side to a point about midway between the anus and the nephridium.

The œsophagus exhibits no contractile tubules.

The body cavity is filled with eggs in one specimen opened, and these fill the nephridia also. These organs are of a pale pinkish colour, and owing to different degrees of contraction, the two organs differ in shape and size. One reaches back to the level of the origin of the dorsal retractor muscle, the other extends further back.

Of the two pairs of retractor muscles, the ventral originates about 9 mm., the dorsal at a point 2 mm. from the anus.

I give below a table showing the relative positions of these muscles, from which it appears that generally the ventral retractors are attached to the body wall at about halfway along the body, or in the posterior third of the body length; the dorsals at about one-sixth or one-eighth the length, measured from the anus.

Distance from the anus of the attachment of the retractor muscles in *P. mawsoni*.

Speci-men.	Body length.	Ventral muscle.	Dorsal muscle.	Notes.
	mm.			
M	17	7	3	Hinder end flat; introvert withdrawn.
N	14	9	2	Hinder end retracted.
O	14	7	2·5	Terminal cone visible.
P	13	11	3·5	Hinder end retracted.
Q	11	5·5	2	
R	10	5	2·5	

Localities.—

Commonwealth Bay, 25 fathoms (3-4 ix 12) (forty-eight).

Commonwealth Bay, 55-60 fathoms (21 xii 13) (three).

Remarks.—It is clearly distinct from *P. margaritaceum* and its varieties. It is true there are some resemblances between this species and *P. georgianum* where the hinder end of the body appears to bear a rounded knob, as in *P. semperi.* The skin is pale in colour, namely, "silvery grey," but it is also translucent and iridescent; moreover, the papillæ are dark and are pear-shaped, while the internal structures show various differences.

In *P. charcoti* Herubel, too, the colour is whitish, but the cylindrical papillæ truncated terminally; the shorter introvert (less than half the body length), and the peculiar relations of the cerebral canal, mark it off from the rest as a very distinct species.

In Selenka's monograph the only other species with four retractors and without hooks recorded from these southern seas is *P. capense* Teuscher, from the Cape of Good Hope. From this species *P. mawsoni* differs in the absence of villi on the contractile tubules, as well as in the absence of eye spots. The retractors in that species do not appear to be so long, judging from Selenka's figure.

PHASCOLOSOMA EREMITA *Sars*, var. AUSTRALE nov.

P. eremita Selenka (1883), p. 12, for synonyms.

P. eremita Chamberlin (1920) p. 4D.

(Plate 11, figs. 12–15.)

A single individual of this northern species was obtained at Station 2, along with *P. margaritaceum*, var. *capsiforme.*

It has the introvert fully extended, but the tentacles are retracted so that only the tips of a few are visible. It is not so definitely marked off from the body as in the previous species, its diameter diminishing gradually. The hinder end of the body is rounded.

The total length is 28 mm., of which the introvert, measured from the anus, is 16 mm. The diameter of body 4 mm., that of the introvert 2 mm.

The body wall is of a dirty-brown colour, thick and opaque; its surface is roughened by circular ridges and the numerous small dark-brown papillae, which are arranged in the intervening furrows.

There are no hooks.

Microscopic examination of the skin.—In the mid-body the circular ridges are yellowish, and the furrows filled with grains of mud, which conceals the bases of the papillæ, consequently it is difficult to get a true profile view of these. But by shifting the cover and by pressure one can see that they are long cylindrical, not much constricted at the base, and with a rounded apex. The height is about three times the width. (Figs. 12, 13.)

At the hinder end the skin is much corrugated, for the circular ridges are connected by irregular longitudinal undulating ridges so as to delimit irregularly quadrate areas. The papillæ here are rather longer than on the body generally.

But on the introvert the papillæ become much shorter than elsewhere, their height being about equal to their breadth (fig. 14); they are paler in colour and more densely arranged. This seems to be a very unusual feature in the distribution of the papillæ.

The anus is small, and the surrounding area is rather paler than the general tint of the skin. The nephridiopores are unrecognisable, being covered with mud.

Internal anatomy (fig. 15).—There is only one pair of retractor muscles, which are attached near the nerve cord at about the middle of the body length, viz., 6 mm. behind the anus.

The nephridia are pale pinkish-brown, small in size, only 2 mm. in length; the pores are situated just in front of the anus.

The intestine presents 12–15 visible coils, circularly and tightly coiled in the anterior portion of the spiral, but posteriorly becoming irregularly arranged, so that it is difficult to count them accurately.

The spindle muscle is very delicate, and I did not note any other attachments, except that the rectum is attached to the body wall by only a short membrane on either side.

Locality.—

Commonwealth Bay, Station 2, 318 fathoms.

Distribution of the species.—Widespread in Northern and Arctic seas (Chamberlin).

Remarks.—It agrees almost precisely with Selenka's diagnosis of *P. eremita* Sars, with, however, the following exceptions :—

(*a*) The skin is there said to be smooth for a few millimetres behind the introvert, but in this variety the papillæ extend continuously over the surface.

(*b*) Selenka found no spindle muscle, whereas in the variety it is present though very delicate and readily broken.

(*c*) The papillæ on the introvert are a little longer than on the body, whereas in the variety they are very distinctly shorter.

(*d*) Further, Selenka's figures of the papillæ (pl. v, figs. 54, 55) from the hinder end of the body are much shorter than those in the variety, which resemble in their proportions those figured for *P. semperi* (fig. 57), where, however, they are longer than in the present worm.

At first I suspected from the form of the papillæ that I was dealing with *P. charcoti* Herubel, but the whole anatomy of the two differs.

PHYSCOSOMA *Selenka.*

PHYSCOSOMA SCOLOPS *Selenka* and *Man.*

P. scolops, Selenka and Man (1883), p. 75.

P. annulatum Hutton, Benham (1904), p. 173.

P. scolops Benham (1912), p. 137.

P. scolops Fischer (1914 B), p. 63.

Two small individuals of this widely distributed sipinculid were obtained off the coast of Tasmania. The label reads "vermes tasmaniæ," and nothing more; there is no indication of depth or locality. It is probable that they were collected off Maria Island with certain Polychætes by Professor Flynn, of Hobart.

One of the two has its introvert extended; its total length is 1·5 mm. by 2·5 mm.

For remarks on this species, see Benham, *loc. cit.*

Distribution.—New Zealand, Kermadec Island, Philippines, Singapore, Red Sea, Gold Coast (West Africa), Mauritius, Zanzibar, Madagascar, Indian Ocean, Pacific Ocean; that is, it is almost entirely tropical and subtropical, but passes south to the New Zealand and Tasmanian waters.

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EXPLANATION OF PLATE 11.

Figs, 1, 2. *Phascolosoma margaritaceum*, var. *capsiforme*.

Fig. 1.—A yellowish papilla and its underlying gland, viewed from above ($\times$ 250). The lines represent ridges running circularly on the skin; the papilla lies in the furrow.

Fig. 2.—An oblique side view of a papilla ($\times$ 250).

Figs. 3–11. *P. mawsoni*.

Fig. 3.—The animal with extended introvert and uncontracted posterior, viewed from the side ($\times$ 2).

Fig. 4.—The animal with introvert invaginated and the posterior end retracted, broadened and flattened, so that the terminal cone is only partially visible ($\times$ 2).

Fig. 5.—Posterior end of the same individual as drawn in preceding figure to show the fossa around the terminal cone, due to the retraction of the hinder end ($\times$ 2).

Fig. 6.—Portion of the skin ($\times$ 35). The lines represent the circular discontinuous ridges.

Fig. 7.—A skin papilla, side view ($\times$ 250).

Fig. 8.—The same in optical section from above ($\times$ 250).

Fig. 9.—The tentacular crown ($\times$ 20). The dorsal surface with its cushion is directed towards the bottom of the plate; the ventral margin carries the unpaired couple of tentacles.

Fig 10.—Dorsal view of the tentacular crown ($\times$ 20).

Fig. 11.—Dissection from the left side ($\times$ 4). The intestine has been cut away; the right dorsal retractor muscle was cut through. The gonads are indicated at the foot of the ventral retractor muscles.

Figs. 12–15. *P. eremita*, var. *australe*.

Fig. 12.—A papilla from the body, obliquely seen from the side. The base was embedded in mud up to the level of the dotted line ($\times$ 35).

Fig. 13.—Another papilla in optical section ($\times$ 35).

Fig. 14.—One of the papillæ from the introvert, paler and much smaller than those on the body ($\times$ 35).

Fig. 15.—Dissected from the left side ($\times$ 4).

INDEX.

[1 Plate.]

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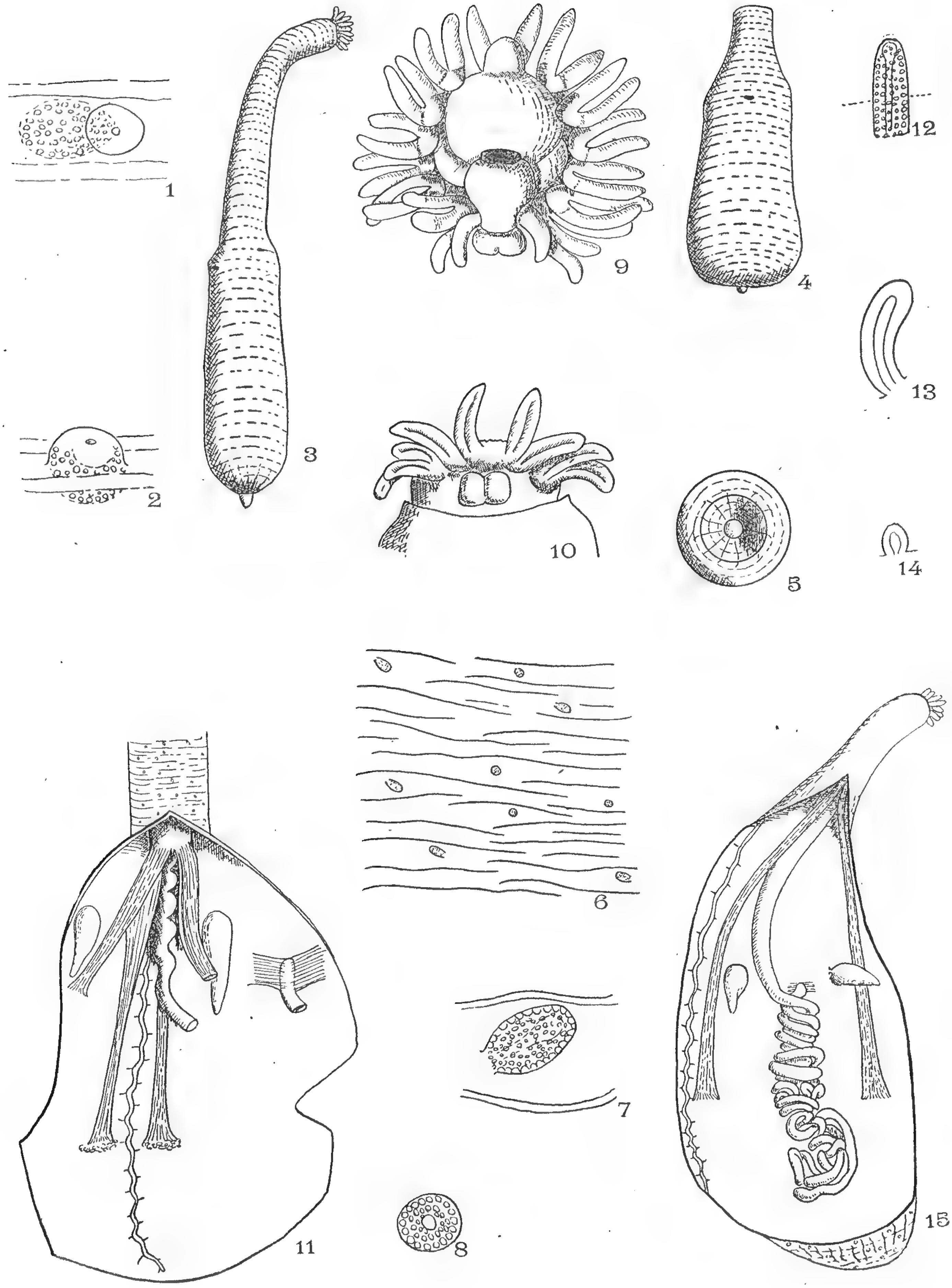
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

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1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, O.B.E., B.E., D.Sc., F.R.S.

SCIENTIFIC REPORTS.

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VOL. VI. PART 6.

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BY

L. R. THORNELY.

WITH FIVE TEXT-FIGURES.

PRICE: TWO SHILLINGS.

Printed by Alfred James Kent, Government Printer, Phillip-street, Sydney.—1924.

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CONTENTS.

POLYZOA.

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(With five text-figures.)

Subclass ECTOPROCTA.

Order GYMNOLÆMATA.

Suborder CHEILOSTOMATA.

AETEA ANGUINA (*Linn.*).

A small colony growing on a Bicellaria.

Locality.—Off Maria Island.

CATENICELLA HASTATA *Busk.*

MacGillivray, Prodr. Zool. Victoria, Dec. III, p. 19, pl. 24.

Locality.—East of Enderby Island, Auckland Islands.

CATENICELLA MARGARITACEA *Busk.*

MacGillivray, Prodr. Zool. Victoria, Dec. III, p. 15, pl. 24.

Locality.—East of Enderby Island, Auckland Islands, 40 fathoms.

BUGULA BICORNIS *Busk.*

Zool. Chall. Exp., Vol. X, Pt. XXX, p. 40.

These colonies form limp, strap-like stems $4\frac{1}{2}$ inches in height, with many fibres given off from the branches. Zoœcia are very long, and their upper free half is usually bent forward so that the surface of the colonies, to the naked eye, has quite a rough appearance. There are numerous short branches given off which have smaller zoœcia as described by Waters.* Avicularia are only to be seen here and there, but have probably been torn off. Oœcia are very tall and lie back at right angles to the zoœcium.

Localities.—Commonwealth Bay, Station 1, 345 fathoms; Station 3, 157 fathoms.

BUGULA RETICULATA *Busk.*

Zool. Chall. Exp., Vol. X, Pt. XXX, p. 40.

Several fragments of colonies having lateral radicles and a marginal spine on either side of the orifice. There is one oœcium present which is lofty as described by Busk.

Locality.—Commonwealth Bay, Station 8, 120 fathoms.

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* Exp. Ant. Belge, p. 21.

BUGULA TRICORNIS *Waters.*

Exp. Antarct., Belge, Zool., Bryozoa, p. 23.

A small fragment only with no oœcia.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

MENIPEA FUNICULATA *MacGillivray.*

Prodr. Zool. Vict., Dec. XVIII, p. 285.

There are many good colonies of this species, about 4 inches in height. Zoœcia are in series of from 2 to 4. The zoarium is continuous and bordered by radicle fibres. There is one stout spine on the outer margin of the zoœcium. The scutum, which has faint marking on it, is large, almost filling the area. Besides the lateral avicularia, there are large raised ones here and there which have pointed mandibles, and there is a small one to one side above the oœcium. Oœcia are large, with a kidney-shaped pore in the centre.

The large central avicularia and the kidney-shaped pore, neither of which is mentioned in MacGillivray's description, are here striking features, but the radicle fibres, stout spine, and scutum correspond with his species.

Locality.—Commonwealth Bay, 3–5 fathoms, 25 fathoms; Station 8, 112 fathoms.

BICELLARIA TUBA *Busk.*

Brit. Mus. Cat. Marine Polyzoa, Pt. I, p. 42.

There is only a fragment of this species without avicularia or oœcia, and the zoœcia are a good deal broken, but show the digitiform, hollow process supporting three long incurved spines, and two other marginal spines situated on the margin behind this process.

Locality.—Off Maria Island.

FLUSTRA SPOLIATA (*Ortman*).

Die Japanische Bryozoa: Arch. f. Naturgeschichte, Jahrg. LVI, Bd. 1, p. 27, Dec. 1889.

These specimens have the unarmed border to the zoœcia, and the avicularia above the zoœcia set askew, elliptical in shape, and with the rounded mandible of *F. spoliata*, but the zoarium here, although varying in the width of its branches, has them usually very narrow, delicate and pale brown in colour, the zoœcia very long and narrow and the avicularia with a curious little round knob at the tip of the mandible. These are points not mentioned in Ortman's description with which the specimens otherwise correspond.

Localities.—Commonwealth Bay, Station 3, 157 fathoms; Station 45, 50 fathoms, 14 Dec., 1913.

Flustra antarctica *Calvet.*

Expéd. Antarctique Française, Bryozoaires, p. 11.

There are some good colonies of this species, the largest $3\frac{1}{2}$ inches in height. There are only one or two oœcia, but they show how the spines, when they are present, become longer, bending in front of the oœcia.

Localities.—Commonwealth Bay, 55 fathoms, 3–5 fathoms, 25–30 fathoms; Station 3, 157 fathoms.

Flustra ovoidea *Busk.*

Carbasea ovoidea, Busk, Cat. Mar. Polyzoa, Pt. I, p. 52.

A few colonies up to 4 inches in height, some with the usual broad fronds, others much narrower, bilaminate except apparently at their extremities. Beneath the aperture the zoœcia are much narrowed and elongated.

Locality.—Commonwealth Bay, Station 3, 157 fathoms.

Flustra spinuligera *Hincks.*

Ann. Mag. Nat. Hist., Ser. 6, Vol. VII, p. 286.

These specimens do not show the broadness of zoarium, a characteristic feature in Hincks's description of this species, and there are no oœcia present, but other features of zoœcia and avicularia are similar.

Locality.—Off Maria Island.

Carbasea elegans *Busk.*

Brit. Mus. Cat. Mar. Polyzoa, Pt. 1, p. 53.

The narrow ligulate divisions of the zoarium of this species are somewhat thick and fleshy, and of a pale brown colour. Zoœcia are remarkably wide above: also the orifice has a very wide opening.

Locality.—Commonwealth Bay, Station 3, 157 fathoms.

Beania erecta *Waters.*

Exp. Antarct., Belge, Bryozoaires, p. 30.

Locality.—Commonwealth Bay, 45–50 fathoms, 25 fathoms, 3–5 fathoms.

Farciminaria aculeata *Busk.*

Brit. Mus. Cat. Mar. Polyzoa, Pt. I, p. 33.

A good colony with oœcia present.

Locality.—Off Maria Island.

Membranipora corbula *Hincks.*

Ann. Mag. Nat. Hist. Ser. 5, Vol. 6, p. 378.

There is one specimen of this species. It has always four articulate oral spines, not two as described by Hincks, nor is one longer than the others, nor are they so thick and pod-like as described by MacGillivray.* There are six small spines on either side that meet across the zoœcium and one central one.

Oœcia are not present.

Locality.—East of Enderby Island, Auckland Islands.

Membranipora elongata *n.sp.* (Fig. 1).

A fragment of a species that has very long zoœcia, oval above, narrowing below, the area occupying nearly the whole of the front wall and bordered by a thick

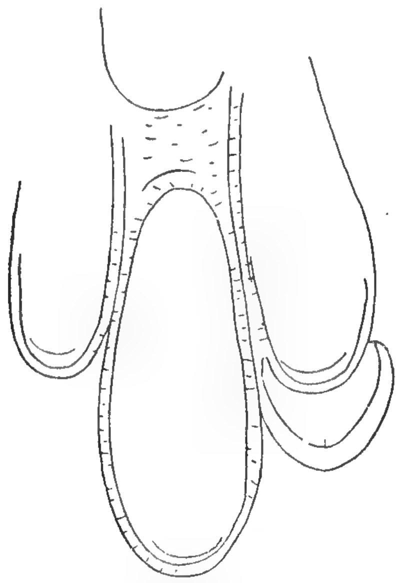

Fig. 1.
Membranipora elongata, n. sp.

crenulated ridge, the small space below the area having a dotted surface. There are no avicularia, but several oœcia which have a smooth area below, divided into two halves by a vertical line, and an arched ridge above.

Locality.—Commonwealth Bay, 25 fathoms.

Cellaria fistulosa (*Linn.*).

Hincks, Brit. Mar. Polyzoa, p. 106.

There are a few avicularia of the characteristic shape on this colony.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

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* Prodr. Zool. Vict. Dec. XIII, p. 103.

Cellaria Wandeli *Calvet.*

Expéd. Antarct. Française, Bryozoaires, p. 23.

There is a $2\frac{1}{2}$-inch branched piece of this form.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

Cellaria membranacea *n.sp.* (Fig. 2).

There is an unbranched, unjointed cylindrical species, about 3 inches long and $\frac{1}{10}$ inch wide with radicles at its base. It is nodulated slightly, like some of the Cellarinellas. Zooecia are large and very thickly calcareous, and there are very large avicularia

Fig. 2.
Cellaria membranacea.

lying between the zooecia, and reaching more than their length, having falciform mandibles that have a central ridge and membranous side expansions, and narrowing upwards, ending in a sharp curved point that rests on a raised beak.

Locality.—Commonwealth Bay, Station 11, 351 fathoms.

Micropora brevissima *Waters.*

Exp. Antarct. Belge, Bryozoaires p. 40.

One small colony only, encrusting a stem of another Polyzoon.

Locality.—Commonwealth Bay, Station 8, 120 fathoms.

Vincularia abyssicola *Smitt.*

Floridan Bryozoa, Pt. II, p. 6.

Several fragments of this form with flattened, branched stems, the largest about 2 inches long. There are large numbers of the peculiar avicularia taking the place of zooecia.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

Cribrilina projecta *Waters.*

Exp. Antarct. Belge, p. 41.

A few zoœcia growing on a Polyzoon having avicularia, but not oœcia present. The proximal edge of the peristome is sometimes raised into prominences like the distal edge.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

Cribrilina spatulata *Calvet.*

Exp. Antarct. Française, Bryozoaires, p. 19.

There is a fragment from one locality that is free growing and bilaminate and has five instead of four spines of the usual shape.

Locality.—Commonwealth Bay, Station 12, 110 fathoms, 25 fathoms, 45–50 fathoms, 25 to 110 fathoms.

Cribrilina monoceros *Busk.*

Brit. Mus., Cat. Mar. Polyzoa, Pt. II, p. 72.

A colony encrusting a Hornera. It is old and very calcareous with large, deep perforations in the front wall which is raised below the orifice, where there are usually three small pointed avicularia on raised areas. There are also two small avicularia with pointed mandibles inside the orifice one on either side. There are a few oral spines on the colony, but no long club-shaped ones.

Locality.—Commonwealth Bay, Station 8, 120 fathoms.

Microporella divaricata *Canu.*

Waters, Exp. Antarct. Belge, Bryozoaires, p. 46.

The specimen corresponds entirely with Waters' description in the erect bilaminate zoarium, the entire surface of the zoœcium being perforated, and in the semicircular depressions above the zoœcia, which probably show the first formation of oœcia; these here have slightly raised margins which continues the idea of their being oœcia. A new point, however, is that the colony has horny connections at intervals, which to the naked eye gives it the appearance of a Cellaria. It is about 2 inches in height.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

Microporella proxima *Waters.*

Exp. Antarct. Belge, Bryozoaires, p. 44.

A single colony on the stem of a seaweed.

Locality.—Commonwealth Bay, Boat Harbour, 3½ fathoms.

MICROPORELLA TRINERVIS *Waters.*

Exp. Antarct. Belge, Bryozoaires, p. 45.

These specimens correspond in all external details with Waters's species, but have also sometimes a small rounded avicularium on either side of the orifice. Oœcia are present.

Locality.—Commonwealth Bay, Station 8, 120 fathoms.

MICROPORELLA INVERSA *Waters.*

Ann. Mag. Nat. Hist., Ser. 6, Vol. IV, p. 6.

A circular colony of this species, growing on a seaweed; probably immature, as the pores are not stellate except the suboral one, and there are no grooves between them. There are the bases of three spines above the orifice, but no avicularia or oœcia. The orifice has a thickened rim and is flattened proximally and distally as described for *Inversiula nutrix* in Waters' comparison of the two species.*

Localities.—Commonwealth Bay, Boat Harbour, $3\frac{1}{2}$ fathoms; Commonwealth Bay, 3–5 fathoms.

MICROPORELLA MALUSII (*Aud*).

Hincks, Brit. Mar. Pol. p. 211.

There is a colony on a seaweed. The pores are not stellate: they form a double or treble row round the margin, and there are three pores across below the orifice. A few zoœcia have four spines. Oœcia have an arched ridge at their lower edge and ridges running upwards also, but no areolations round the margins, and the central pore is crescentic, not toothed. There are a few zoœcia growing on a Hornera from another locality that have four branched spines. Busk† mentions occasional forked spines. *M. parvipora* (Waters)‡ has marginal, non stellate-pores and a crescentic median pore, but it is smaller and has a smaller orifice than here and also more marginal spines.

Localities.—Commonwealth Bay, 3–5 fathoms; Station 8, 120 fathoms.

LEPRALIA MARGINATA *Calvet.*

Exp. Antarct. Française, p. 24.

By the shape of the orifice, the marginal pores, central, rounded avicularium and the hole in the centre of the oœcium this species corresponds with Charcot's description, but the fragments of colonies here are foliaceous, having apparently been folded loosely round some foreign object, excepting one fragment which is free and bilaminate, the rest being unilaminate with a little process on the dorsal surface of some zoœcia, possibly for attachment.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

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* Mission Sci. du Cape Horn, Bryozoaires, p. 44, pl. iv, fig. 8. † Chal. Exp., pt. xxx, p 137. ‡ Exp. Antarct. Belge., p. 43.

SCHIZOPORELLA TUMIDA (*Hincks*) var. *tricuspis*.

Calvet, Exp. Antarct. Française, Bryozoaires, p. 28.

There are no vicarious avicularia or oœcia to help in the identification of this species. The fragment is bilaminate.

Locality.—Commonwealth Bay, Station 1, 354 fathoms.

SCHIZOPORELLA HYALINA (*Linn.*).

Hincks, Brit. Mar. Pol., p. 271.

Growing on the stem of a Barentsia.

Localities.—Commonwealth Bay, Station 2, 318 fathoms, and 25 fathoms and 3–5 fathoms.

SCHIZOPORELLA SIMPLEX (*d'Orb.*).

Waters, Exp. Antarct. Belge, Bryoz., p. 51.

A small well-preserved young colony with oœcia, growing on *Phylactella lyrula* and other Polyzoa.

Localities.—Commonwealth Bay, Station 7, 60 fathoms; Station 8, 120 fathoms.

CYCLICOPORA POLARIS (*Waters*).

Exp. Antarct. Belge, Bryoz., p. 53.

The zoœcia correspond entirely with Waters's description and figure, but the zoarium is free-growing, forming much-branched flattened fronds, looking like a Carbasea excepting for frequent horny flexible portions not quite the same as the joints in Cellaria. The fronds are sometimes broad, sometimes quite narrow.

The front walls of the zoœcia are very brittle and occasionally there is a small rounded avicularium to one side of the orifice, and two small horns above it. There are a few oœcia, very large, taller than broad, and apparently smooth, but they are much cracked, being brittle, like the zoœcia. The colonies much resemble *Carbasea pisciformis* (Busk)*, but are bilaminate jointed and calcareous.

Localities.—Commonwealth Bay, Station 7, 60 fathoms, 25–30 fathoms.

SYSTENOPORA CONTRACTA *Waters*.

Exp. Antarct. Belge, Bryoz., p. 56.

There are two colonies about 2 inches in height, the zoarium is flattened and wider than figured by Waters, and slightly contracted at intervals up the stem. There are numerous rootlets at the base.

Locality.—Commonwealth Bay, Station 2, 318 fathoms.

* B.M.C., t. I, p. 50.

Cellarinella foveolata *Waters.*

Exp. Antarct. Belge, Bryoz., p. 57.

A branched colony.

Locality.—Commonwealth Bay, Station 2, 318 fathoms.

Cellarinella dubia *Waters.*

Exp. Antarct. Belge, Bryoz., p. 58.

A small much-worn fragment. The pitted surface is not visible. There is a horn-like process above the orifice as well as the two lateral avicularia, which has not been mentioned by Waters.

Locality.—Two miles off Macquarie Island, 60 fathoms.

Cellarinella Watersi *Calvet.*

Exp. Antarct. Française, Bryoz., p. 33.

A fragment 3 inches in height that appears to represent part of a large colony.

Locality.—Commonwealth Bay, 45–50 fathoms; Station, 3,157 fathoms.

Cellarinella nodulata *Waters.*

Exp. Antarct. Belge, Bryoz., p. 58.

There are always two avicularia in this specimen, which is 1 inch in height. There is a fragment from another locality which is not nodulated, and is larger in every way and the avicularia have disappeared, but the pitted surface and central mould are present, and I believe it to be an old colony of the same species.

Localities.—Commonwealth Bay, Station 11; 35 fathoms, Station 2, 318 fathoms.

Smittia conspicua *Waters.*

Exp. Antarct Belge, Bryoz., p. 66.

Locality.—Commonwealth Bay, Station 2, 318 fathoms.

Smittia antarctica *Waters.*

Exp. Antarct. Belge, Bryoz., p. 65.

There are some large broken pieces.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

SMITTIA MARSUPIUM *MacGillivray.*

Prodr. Zool., Vict., Dec. IV, p. 22.

There are two colonies of this charming little species. An older one has four spines on the zoœcia and an umbo on the oœcia and the sides of the peristome are raised. In the other, younger colony, there are five spines. The pouch-like protuberance and small rounded avicularium are common to both colonies.

Locality.—Commonwealth Bay, 25 fathoms.

SMITTIA LANDSBOROVII *Johnston.*

Hincks Brit. Mar. Pol., p. 341.

There are a few zoœcia only of this form growing on the back of *Smittia reticulata.*

Locality.—Commonwealth Bay, Station 2, 318 fathoms.

SMITTIA RETICULATA *MacGillivray.*

Hincks Brit. Mar. Pol., p. 346.

The wide spatulate avicularia and almost square shape of the orifice make a decided variation on Hincks's form. Also the fragments, the largest of which is an inch by half an inch in size, are either free growing, or loosely attached, but it is impossible to tell the form of the colony; they are unilaminate. There are the three internal denticles, the marginal areolations and occasionally two spines above the orifice of *S. reticulata.*

Locality.—Commonwealth Bay, Station 2, 318 fathoms.

SMITTIA TRIPORA *Waters.*

Exp. Antarct. Belge, Bryoz., p. 67.

There are fragments of an encrusting species and some folded over on themselves. Avicularia lie horizontally on the top of the swollen portion, just in front of the central denticle, and within the secondary orifice, or in a sinus in the secondary orifice. In an old specimen the swollen portion is inclined to rise into an umbo in front of the avicularium. Zoœcia are larger in every way than those of *Porella marsupium* which they resemble most.

Localities.—Commonwealth Bay, Station 7, 60 fathoms; east of Enderby Island.

MUCRONELLA TERES *Hincks.*

Ann. Mag. Nat. Hist., Ser. 5, Vol. VIII, p. 124.

A few zoœcia only, growing on a Polyzoon. There are at least seven spines: the central tooth is broad with sharp lateral points. There are no lateral teeth. The zoœcia are very small.

Locality.—Commonwealth Bay, Station 12.

MUCRONELLA CORONATA, *n.sp.* (Fig. 3).

Zoarium encrusting. Zoœcia large, with a coarse roughened surface, a thick rounded mucro hiding the lower edge of the orifice, which is arched above and straight below. On either side of the orifice there is a stout projection, straight to begin with, then bending forward and ending in a sharp spine, while two or three sharp spinous processes are given off from its upper bent surface so as to form altogether an encircling crown-like formation.

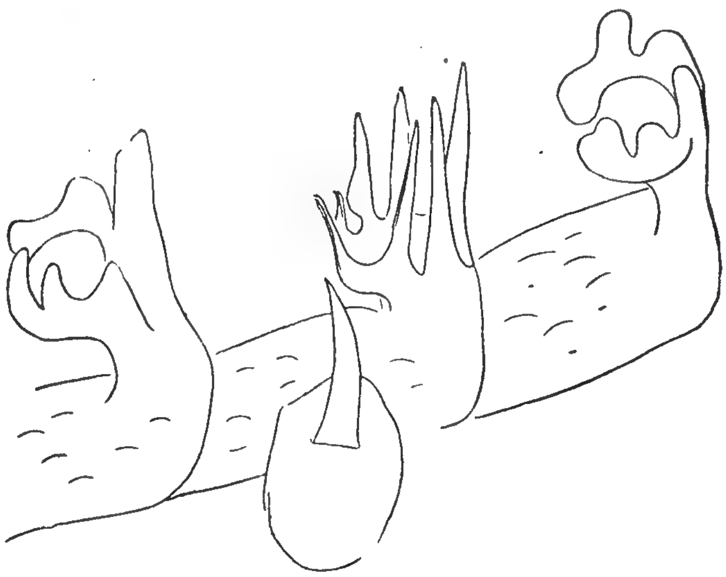

Fig. 3.
Mucronella coronata, n. sp.

There are avicularia on some zoœcia, very long and pointed and situated on large prominences on the sides of zoœcia. Oœcia are large and globose with a surface less coarse than that of the zoœcia.

This is a striking species—the zoarium to the naked eye showing the bristling spines of the crown and having a glistening surface. There is only one colony, which surrounds loosely the branches of a seaweed.

Locality.—Commonwealth Bay, Station 8, 120 fathoms.

MUCRONELLA CONTORTUPLICATA *Calvet.*

Exp. Antarct. Française, Bryoz., p. 36.

A colony that has probably loosely encircled some foreign object, zoœcia being on the outside only of the cylinder it has formed.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

PHYLACTELLA LYRULATA *Calvet.*

Exp. Antarct., Française, Bryoz., p. 32.

There is a good quantity of material of this species, but it mostly consists of old broken fragments. Charcot had only one small imperfect colony, so that there are

additional features to describe here. The primary orifice has the lyre-like central tooth wh'ch Busk* describes for *Mucronella bisinuata* Smitt, as of *rare occurrence*, the central tooth here, however, is laterally pointed. The secondary orifice is much raised tubularly, the front portion more than the back, and this often rises to a pointed mucro. There are some oœcia present—large and globose with a surface roughened like the zoœcia, but without marginal perforations.

Localities.—Commonwealth Bay, 45–50 fathoms; Station 12, 110 fathoms; Station 2, 318 fathoms; Station 1, 354 fathoms; Station 7, 60 fathoms.

Aspidostoma giganteum (*Busk*).

Brit. Mus. Cat., Part II, p. 91; Zool. Chall. Exp., Vol. X, Pt. XXX, p. 161.

There are branched fragments about 2 inches in height, bilaminate. The pent-house like projection usually rises into stout, horn-like processes on either side of the orifice, and where an oœcium is present, a small, arched opening into this lies between the horns. I have seen no avicularia on these specimens.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

Aspidostoma obliquum, *n.sp.* (Fig. 4).

There are two small fragments of a colony, unbranched, the stem almost flat and slightly nodulated.

Zoœcia are neatly hexagonal, their surface granulated, depressed beneath the orifice. Orifice arched above, shielded below by a square mucro: the operculum fitted

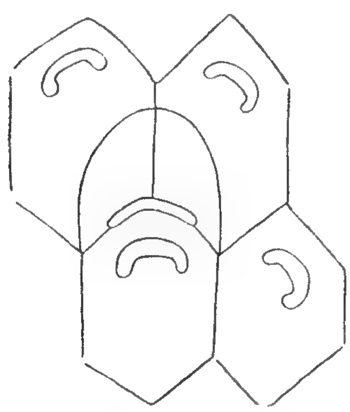

Fig. 4.
Aspidostoma obliquum, n. sp.

round this is of a narrow kidney shape. The orifice is often obliquely set. There are no avicularia present. Oœcia are large, seen embedded under the two zoœcia situated above the arc to which it belongs, the opening being just above the margin of its zoœcium, arch-shaped.

* Zool. Chall. Exp., Vol. X, pt. XXX, p. 157.

The characteristic pent-house process is not present in this species, and I have not been able to see whether the mucro continues down within the zoœcia, but what can be seen of the character supports its belonging to *Aspidostoma.*

It is a remarkably pretty species with its shining surface and golden opercula.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

HASWELLIA AUSTRALIENSIS (*Haswell*).

Myriozoum australiense Haswell, Proc. Linn. Soc. N. S. Wales, Vol. V, pt. 1, p. 43,
Haswellia australiensis, Busk Zool. Chall. Esp. Vol. X, Pt. XXX, p. 172.

There is a small broken piece of this species.

Locality.—East of Enderby Island, Auckland Islands.

CELLEPORA EATONENSIS *Busk.*

Zool. Chall. Exp., Vol. X, Pt. XXX, p. 201.

These specimens are encrusting stems of varying thickness. The rostra vary in length, but are a'ways open above, spout-like, with a rounded avicularium inside at its summit. There are numerous vicarious avicularia with duck-bill-shaped mandibles, closing down into deep cup-like beaks. Oœcia, which Busk does not mention, have a smooth surface with a small arched area on the front wall.

Locality.—Commonwealth Bay, 45–50 fathoms; Station 3, 157 fathoms.

CELLEPORA SETOSA *n. sp.* (Fig. 5).

Zoarium large, branched, bristling with rostra. Zœocia smooth with small, scattered, rounded avicularia and a suboral rostrum often of enormous length, which is cylindrical below, flattened above, and ending in a large central and two smaller lateral

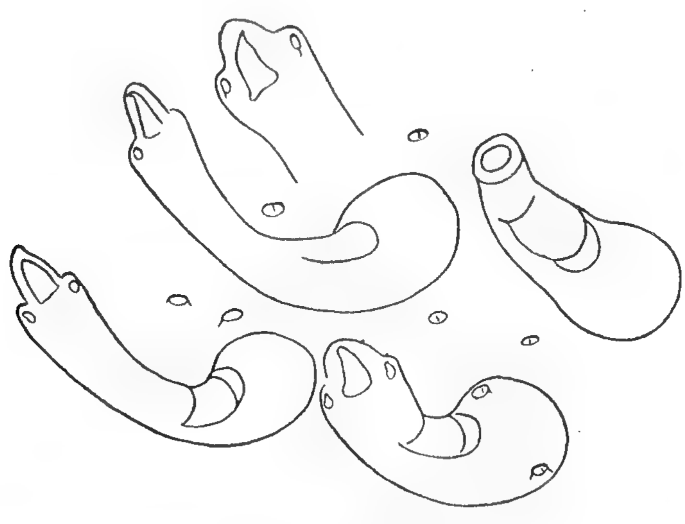

Fig. 5. Tube 19.
Cellepora setosa, n. sp.

points, bearing avicularia at their summits, the central one broad and pointed, the lateral ones smaller and round. Oœcia are large and smooth.

Localities.—Commonwealth Bay, Station 12, 110 fathoms; Station 8, 120 fathoms.

TURRITIGERA STELLATA *Busk.*

Zool. Chall. Exp., Vol. X, Pt. XXX, p. 130.

There are one or two fragments of a free-growing, calcareous, bilaminate nature that may be young growth of this species. The front wall and tubular orifice are thick except towards the edge of the zoarium, where some rise to a thinner, taller tube, while the proximal side develops a spout-like process bearing a small avicularium at the top of its inner aspect. There are a few oœcia situated below the orifice on the front wall, having a small circular, finely perforated area. In this last point it differs from *T. stellata* particularly, but without more material I am inclined to consider it to be that species.

Locality.—Off Maria Island.

RETEPORA PLANA *Hincks.*

Ann. Mag. Nat. Hist., Ser. 5, Vol. I, p. 358.

This fragment, about 2 inches x 1 inch in size, has the large fenestrae, pointed above and below, described by Hincks, with three or four rows of zoœcia in the interspaces. Zoœcia are very simple, as he describes, with only one rounded avicularium on an umbo below the orifice, excepting for an occasional small one on the dorsal surface. The orifice is as described, but the lateral walls of the peristome are sometimes raised a little. There were no oœcia on his specimen. Here they are present, smooth with a vertical slit-like fissure in front.

Locality.—Commonwealth Bay, Station 8, 120 fathoms.

RETEPORA GELIDA *Waters.*

Exp. Ant. Belge, Bryoz., p. 84.

There are only some fragments of this species.

Localities.—Commonwealth Bay, Station 7, 60 fathoms; Station 8, 120 fathoms.

RETEPORA LEPRALIOIDES *Waters.*

Exp. Ant. Belge, Bryoz., p. 83.

Some broken pieces with the characteristic features of this species.

Locality.—Station 2, 318 fathoms.

RETEPORA FRIGIDA *Waters.*

Exp. Ant. Belge, Bryoz., p. 82.

There are many fragments of this species from 1 to 2 inches in height, variously folded on themselves. They have all the features of this species in zoœcia and oœcia,

and have the large raised elliptical avicularia on the front and back walls of the zoarium, but they have very few spines present on the zoœcia, though indications of two and four can be seen on some.

Localities.—Commonwealth Bay, Boat Harbour, 3½ fathoms; Station 7, 60 fathoms; Commonwealth Bay, 25 fathoms, and 55 fathoms.

Suborder CYCLOSTOMATA.

Crisia biciliata *MacGillivray.*

Prodr. Zool. Vict., Dec. IV, p. 37.

Localities.—East of Enderby Island; Auckland Islands, 40 fathoms.

Crisia cornuta (*Linn.*).

Hincks, Brit. Mar. Poly., p. 419.

Locality.—Commonwealth Bay, Station 12, 110 fathoms.

Idmonea australis *MacGillivray.*

Prodr. Zool. Vict., Dec. VII, p. 30.

There are two fragments about 1 inch long, dichotomously branched.

Locality.—Commonwealth Bay, Station 8, 120 fathoms.

Hornera foliacea *MacGillivray.*

Prodr. Zool. Vict., Dec. XII. p. 71.

Part of a colony 2½ inches in height.

Locality.—Enderby Island, Auckland Islands.

Hornera caespitosa *Busk.*

Brit. Mus. Cat., Pt. III, p. 17.

A 3-inch fragment of a colony of this species.

Locality.—Commonwealth Bay, Station 8, 120 fathoms.

Hornera antarctica *Waters.*

Exp. Antarct. Belge, Bryoz., p. 93.

A small branched portion of a colony.

Locality.—Commonwealth Bay, Station 1, 354 fathoms.

Lichenopora hispida *Fleming.*

Hincks, Brit. Mar. Pol., p. 473.

A colony growing on *Phylactella lyrula.*

Locality.—East of Enderby Island, Auckland Islands.

Fasciculipora gracilis *MacGillivray.*

Prodr. Zool. Vict., Dec. XVI, p. 213.

There are several colonies of this form, less than half an inch across, situated on weeds. Branches radiate from the centre of the colony in five or six rays, which again divide several times, and are composed of bundles of long, free, tubular, slightly curving zoœcia, which have their surface perforated and their openings at the top.

Locality.—Commonwealth Bay, 25 fathoms.

Sub-class ENTOPROCTA.

Barentsia discreta (*Busk*).

Waters, Exp. Antarct. Belge, Bryoz., p. 99.

A colony growing on the stem of a Sertularian and one on a *Menipea.*

Localities.—Commonwealth Bay, 25–30 fathoms, and 55 fathoms.

INDEX.

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1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, O.B.E., B.E., D.Sc., F.R.S.

SCIENTIFIC REPORTS.

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VOL. VI. PART 7.

EDITED BY E. A. BRIGGS, D.Sc.,
UNIVERSITY OF SYDNEY.

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BY

N. A. COBB, B.Sc., Ph.D.,

Bureau of Plant Industry, U.S. Department of Agriculture.

WITH FOURTEEN TEXT FIGURES

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CONTENTS.

MARINE FREE-LIVING NEMAS.

By N. A. COBB, B.Sc., Ph.D.,

Bureau of Plant Industry, U.S. Department of Agriculture.

[With fourteen Text Figures.]

Examination of these Antarctic free-living nemas corroborates the impression created by previous examination of the free-living marine nemas of the Shackleton Expedition; in other words, it becomes abundantly evident that the Antarctic marine waters are populated by an infinitude of nemas belonging to widely varied species that time will undoubtedly prove to be an important link in the organic series culminating in the fishes, birds, and marine mammals of Antarctica.

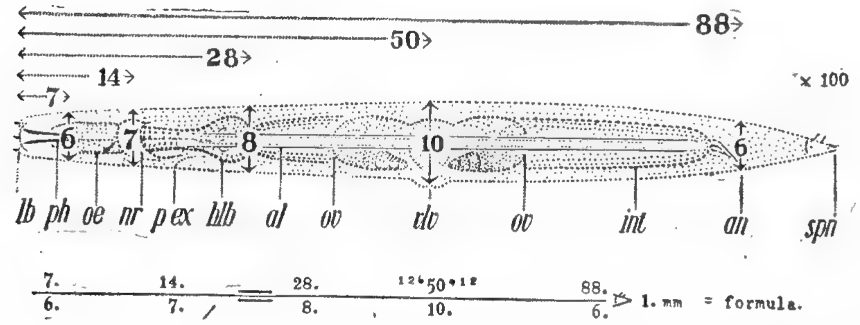
With regard to the locality from which the nemas were collected, Mr. J. G. Hunter, Chief Biologist of the Mawson Expedition, says:

"The specimens were collected by Dr. McLean, 1913, from a muddy sediment, 3 fathoms, Commonwealth Bay (Adelie Land). Small nemas could always be found in abundance in this mud; the larger forms were obtained from amongst the roots of brown algæ (Fucoideæ)."

The specimens were preserved in formalin originally. After receipt by the writer, they were treated with corrosive sublimate and examined in balsam after staining with carmine.

Unfortunately many of the specimens were very defective, owing, no doubt, to the great difficulties under which they were collected, so that obtaining from them the data here published required much patience and delay.

The following diagram illustrates the decimal formula used for nemas; 6, 7, 8, 10, 6 are the transverse measurements, while 7, 14, 28, 50, 88 are the corresponding longitudinal measurements. A formula assembling these measurements appears just below the diagram. The unit of measurement is the hundredth part of the length of the body, whatever that may be. The measurements become, therefore, percentages of the length. The absolute length of the nema is given in millimetres as a final term—in this case 1 mm.



The measurements are taken with the animal viewed in profile; the first are taken at the base of the pharynx, the second at the nerve-ring, the third at the cardiac constriction or end of the neck, the fourth at the vulva in females and at the middle (M) in males, the fifth at the anus. In most cases the formulæ given represent an average derived from the measurements of several adult individuals.

By the use of suggestive conventional signs the formula is made to convey considerable additional information. Thus the formulæ for *Spilophora aberrans* (No. 11), p. 19 indicate that:

Terminology Relating to Striation of Cuticle

Number of Striae to the millimeter	Corresponding text term	Corresponding formula line
100 down	Very coarse	——— ———
250	Coarse	— — — —
500	Rather coarse	- - - - - - -
750	Rather fine	. . . .
1000	Fine	. . . . . .
1500	Very fine	. . . .
2000 up	None	

The cuticle is traversed by rather coarse transverse striæ,[1] which are resolvable into rows of dot-like markings[2] modified on the lateral fields,[3] where there are distinct wings to the cuticle, one on each side of the lateral line.[4] The excretory pore is at the base of the lip region.[5] There is an almost imperceptible pharyngeal swelling and a cardiac swelling three-fourths as wide as the base of the neck.[6] The ovaries are double and reflexed, the anterior one occupying 18 per cent. of the length of the body, the posterior one 17 per cent.[7] The male has a single outstretched testis occupying 63 per cent. of the length of the body.[8] There is an unarmed symmetrical spinneret.[9] The spicula are arcuate and their proximal ends cephalated by constriction.[10] There is only one gubernacular piece; it is arcuate, slender, lies parallel and close to the spicula, and is one-half as long as they.[11] There are probably ten preanal ventral supplementary organs.[12]

---

[1] Formula line of short dashes. See table of striation of cuticle on this page.

[2] Dots above and below the line between the second and third terms.

[3] Modified dots outside those just mentioned in [2].

[4] Short lines above and below formula line between second and third terms.

[5] Oblique line on the first transverse term.

[6] Underscoring the first and third diametral measurements, thus indicating the presence of a bulb at that point. Length of mark indicates size of bulb. The first stroke is dotted to indicate that this bulb is faint. A median bulb would be indicated by a mark under the second term.

[7] Single quotes before and after 47, and 18 and 17 used as exponents. Ovaries double and outstretched are indicated by dashes before and after vulva measurement, *e.g.*, —47—; if single, —47.

[8] The straight stroke before M, and 63 used as exponent.

[9] Angular sign at end of formula line. Armature is expressed by strokes across the sign. See *Parasabatieria antarctica*. p. 16.

[10] The curved line with separated end in front of last transverse measurement.

[11] Small curved mark next the one mentioned in [10]. If there is an apophysis to gubernaculum, a stroke is indicated at the proper angle to this mark. indicates an apophysis that extends backward at an angle of 90 deg. with the spicula.

[12] 10 used as subfigure in front of spicula. ? expressing probability.

The presence of a bursa is indicated by a curved stroke under the transverse anal measurement figure, and the number of bursal ribs in front of and behind the anus by suffixes in front of and behind the anal measurement figure. Different degrees of curvature of the spicula are expressed in marks placed in front of the transverse anal measurement of the male. Straight spicula, arcuate (as shown in male formula for *S. aberrans*) and strongly arcuate may be indicated by straightening or curving the arc. The nature of the proximal ends is given, *i.e.*, whether cephalated and if cephalated whether by expansion, contraction or constriction, *e.g.*,

When the features represented in the diagram are not of a pronounced nature, the marks are dotted to indicate faintness. The absence of any mark in the formula is practically always to be taken as indicating that the particular feature in question is non-existent, although the possibility must not be overlooked that it was present but escaped notice.

Thus the formula is a sort of conventionalized sketch of the organism, much use being made of "place value" as well as form value, just as in mathematical notation, music, etc.

Key.

Pharynx absent, or, rather, apparently so .... –♀– –♂– .... (*Parasabatieria antarctica*) 8
Pharynx present, though sometimes very small
Wall of the pharynx armed with one or more onchia or teeth—
Onchium only one.
Cardiac bulb none .... –♀ .... *Cobbia mawsoni* 6
Cardiac bulb distinct, pyriform or elongate.
Cuticular "wings," 12; pharyngeal bulb set off by constriction .... *Monoposthia apiculata* 12
Cuticular "wings," 2; pharyngeal bulb not set off by constriction .... '♀' –♂ .... *Spilophora aberrans* 11
Onchia two or more.
Neck 23%; pharynx capacious; its 3 teeth large, oncholaimoid .... *Hyptiolaimus cephalatus* 13
Neck 15% or less; pharynx and teeth not large, external amphids linear.
Width 4·3%; total length 1·3 mm. .... '♀' –♂ .... *Chromadora dubia* 9
Width 2·8%; total length 2·4 mm. .... '♀' –♂ .... *Euchromadora meridiana* 10
Wall of the usually ob-conoid pharynx unarmed; lips armed in Axonolaimus—
Œsophagus plain, valveless, cylindroid or conoid.
Amphids sometimes obscure .... – ♀ –♂– .... (*Monhystera naviculivora*) 3
Amphids present, obvious.
External amphids linear, *i.e.*, more or less narrow slits .... '♀' ?♂ .... *Anticoma subsimilis* 1
External amphids spiral, circular, or elliptical.
Form of the amphids a distinct spiral, appearing circular in 2.
Lips armed with 6 distinct, outward acting odontia .... –♀– –♂– .... *Axonolaimus polaris* 15
Lips inward acting, without distinct odontia.
Annules resolve to secondary elements; lips amalgamated .... –♀– –♂– .... *Parasabatieria antarctica* 8
Annules not so resolvable; lips, 3, distinct, well developed .... '♀' .... *Tripyloides vivipara* 2
Form of the external amphids circular, elliptical, or elongate.
Contour of external amphid not circular.
Amphid elongate and relatively large; œsophagus 13%; width 2·5% .... –♀– –♂– .... *Axonolaimus antarcticus* 14
Amphid equidiametral; œsophagus 6·2%; width 1·1% .... –♀– –♂– .... *Axonolaimus polaris* 15
Contour of external amphid circular.
Ovaries two, outstretched.
Lips inward acting, subdistinct, unarmed .... –♀– ?♂? .... *Metalinhomoeus meridionalis* 7
Lips armed with 6 outward acting odontia .... –♀– –♂– .... (*Axonolaimus polaris*) 15
Ovary one, outstretched; striæ simple, faint (unknown in No. 4).
Male with 2 outstretched testes; width 3·8% or more .... –♀ –♂– .... *Monhystera naviculivora*
Male with 1 outstretched testis, (unknown in No. 6); width 2·5% or less.
Outer amphid $2\frac{1}{2}$ head-widths back .... –♀ –♂ .... *Monhystera septentrionalis* 5
Outer amphid 1 head-width back.
Length 2·2 mm. .... –♀ .... (*Cobbia mawsoni*) 6
Length 1·2 mm. .... –♂ .... *Monhystera neglecta* 4
Œsophagus with posterior swelling; amphids spiral .... –♀– –♂– .... (*Parasabatieria antarctica*) 8

DESCRIPTIONS OF THE SPECIES.

CHARACTERS COMMON TO ALL THE SPECIES.

The cuticle is colorless, except in *Spilophora aberrans* n.sp., where it is yellowish. Transverse striæ are present, not materially altered on the lateral fields except in *Chromadora* and *Spilophora.* No longitudinal striæ have been seen in these balsam preparations, except in *Hyptiolaimus* n.g.

There are no eyespots.

There is no median œsophageal bulb. The musculature of the œsophagus is colorless and fine, except in *Tripyloides.* Glands in the interior of the œsophagus have not been seen except possibly in *Hyptiolaimus* n.g. There are no valves in the œsophagus except in *Spilophora aberrans* n.sp.

There is no prerectum. The intestinal granules give rise to a tessellation only in *Cobbia mawsoni* n.sp. and possibly *Tripyloides vivipara* n.sp.

The tail is of approximately the same form in both sexes (if both are known) and in all cases is supplied with a simple spinneret, and with caudal glands, the latter confined to the tail, except possibly in *Hyptiolaimus* n.g.

The renette, when present, has its cell behind the neck, except in *Anticoma.*

The nerve-ring surrounds the œsophagus squarely in *Axonolaimus polaris* n.sp. and nearly so in all others.

There are two equal simple spicula. There is no bursa. There are no special papillæ or setæ on the male except in *Anticoma subsimilis* and *Axonolaimus antarcticus* n.sp.

Genus ANTICOMA *Bastian,* 1865.

ANTICOMA SUBSIMILIS *Cobb.*

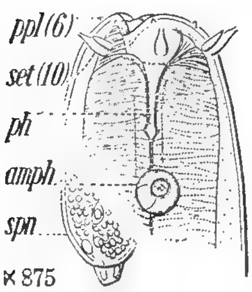
1. *A. subsimilis* Cobb, 1914. $\dfrac{0.2 \quad 11. \quad 24. \quad {}^{12}\,49.\,{}^{13} \quad 90.8}{0.7 \quad 1.7 \quad 2. \quad 2.1 \quad 1.6} 1.7\text{mm}$ — Supplementing the original data, these are the measurements of a single female specimen undoubtedly belonging to this species.

Genus TRIPYLOIDES *De Man,* 1886.

TRIPYLOIDES VIVIPARA *n.sp.*

2. *T. vivipara* n.sp. $\dfrac{0.6 \quad 6.5 \quad 12. \quad {}^{22}\,47.\,{}^{23} \quad 94.}{1. \quad 1.8 \quad 1.9 \quad 2.3 \quad 1.4} 2.4\text{mm}$ — The thin layers of the transparent, naked cuticle are traversed by exceedingly fine transverse striæ which are very difficult of resolution. The contour of the body is plain. At

least the largest of the cephalic setæ are two-jointed. There are no subcephalic or cervical setæ. The mouth opening is depressed. There are three distinct, mobile, thick, more or less blunt, rounded, well developed lips, not set off by constriction, which, when open, show a definite axil between each adjacent two. The simple, regular, pyramidal or concave-conoid pharynx is of moderate size. There are perhaps obscure cutinous ridges in the basal part of the pharynx. There are only traces of a separate chamber as seen in some *Tripyloides.* The inconspicuous circular amphids are really spirals of one wind, obscurely open behind. The intestine, which becomes at once



three-fourths as wide as the body, has thick walls,—becoming thinner posteriorly, however,—and in each cross section presents about twenty cells with relatively large nuclei; the intestinal lumen is only very faintly to be seen. The colorless granules of the intestine are few and inconspicuous; there is no distinct tessellation although the contours of the relatively small, numerous cells are distinctly seen. From the slightly raised anus, the posterior lip of which is the more prominent, the straight tail is first conoid, then finally subcylindroid in the posterior fourth. It tapers to an unswollen, rounded, naked, symmetrical terminus which ends in an unarmed, truncate-conoid, somewhat inconspicuous spinneret. The spinneret presents a central boss of considerable size. The broadly saccate caudal glands are located in the anterior two-fifths of the tail in a close tandem series and empty through distinct ducts which widen into three distinct ampullæ. There are no caudal setæ. From the small, inconspicuous, continuous vulva, the medium-sized, tubular, more or less weak vagina leads inward and at right angles to the ventral surface about halfway across the body. In the adult females the uteri contain four to six fully developed larvæ which have manifestly escaped from the shells; *i.e.*, the species is probably truly viviparous. The ovaries are broad, somewhat tapering, with their contents irregularly arranged. In young specimens the ovaries may reach back to the vulva; when gravid one-third to halfway. Alongside the ova in the reflexed part of the ovary, there are cells of a different character with elongated nuclei near the periphery. These are probably developing spermatozoa. The collection contained many females in gravid state.

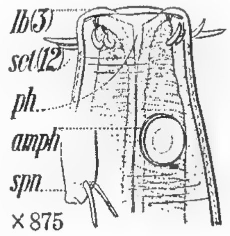
Genus MONHYSTERA *Bastian,* 1865.

In addition to the characters given on page 9, the following are common to all the species of *Monhystera* here described.

The elements of the cuticle are difficult of resolution and are not further resolvable into secondary elements. Submedian cephalic setæ are present, but there are no cervical setæ. The amphids are circular. The œsophagus is without swellings. The males have a single, slender gubernacular piece without apophysis.

MONHYSTERA NAVICULIVORA *n.sp.*

3. *M. naviculivora* n.sp. $\frac{0.5}{1.4} \cdot \frac{8.2}{2.4} \cdot \frac{22.}{2.7} \cdot \frac{^{55}-67.}{3.8} \cdots \frac{87.}{2.3}$ ♂ 1.6 mm —The moderately thin, transparent, naked cuticle is traversed by plain transverse striæ. The contour of the nema is plain. The body wall is thick and relatively muscular. There are longitudinal muscle-striæ prominently interrupted by the lateral chords. The conoid neck ends in a more or less cylindroid, rounded, continuous head, bearing three thin, well developed lips set off by almost imperceptible expansion. No papillæ were seen on these evidently mobile lips. No subcephalic setæ were seen. The simple, conoid, regular pharynx of moderate size is of typical monhysteroid form and about half as wide as the lip region and about two-thirds as long as it is wide; it has no armature. Behind the cyathiform part of the pharynx there are three straight cutinized refractive elements capable of closing together at the axis of the head. These are about as long as the cyathiform part is deep. Hence the pharynx is deeper than might be thought and is capable of being opened to a plain conoid cavity two-thirds as deep as the head is wide. The amphids seen in dorso-ventral view appear as round-bottomed cavities reaching one-fourth the distance to the body axis. There is a staining nucleus on the outer margin in front of the amphid,—of somewhat irregular form. The œsophagus is of typical form. The thick-walled intestine becomes at once three-fifths as wide as the body. The cells of the intestine are packed with small brownish granules; its lumen is rather distinct, sometimes appearing as if longitudinally corrugated. The anus is elevated in the male and the tail is conoid, then cylindroid in the posterior fourth, where it is about one-eighth as wide as at the anus. The spinneret is somewhat swollen; it is rounded and symmetrical and is armed with setæ. The three somewhat broadly saccate caudal glands, packed in the anterior third of the tail, empty through distinct ducts, one starting from the ventral side of each gland at its hind end. Nothing is known concerning the renette. From the large, conspicuous, depressed vulva, the vagina leads inward and forward, there being no very noticeable portion of the sexual organ behind the vulva. The ovary, of course, is single, and at its blind end, which lies near the cardiac collum and apparently is not reflexed, there is sometimes to be seen a very distinct and strongly staining "terminal" cell. Nothing is known concerning the eggs. The ventral region on both sides of the vulva is slightly elevated. A rather sudden and noticeable diminution in diameter of the nema occurs just behind the vulva. The taper of the tail really begins near the vulva but continues gradually until behind the anus, where it becomes more abrupt. From the large depressed anus, the rectum, which has a rather conspicuous but thin refractive lining, extends inward and forward a distance equal to the anal body diameter. This species is distinctly diatomivorous; the diatoms seen in the intestine of the present specimens are mainly a species of *Navicula*. Not



infrequently the intestine is crowded with the frustules of the *Navicula,* many of which are fully as long as the body of the nema is wide and half as wide as the head end of the nema. As many as 150 diatoms have been seen in the intestine of one individual.*

$\frac{0.5}{1.2}\cdots\frac{8.}{2.6}\cdots\frac{21.}{3.2}\cdots\frac{^{78}\text{-M-}}{3.9}\cdots\frac{88.}{2.7} > 1.6\text{mm}$—The spicula are more or less L-shaped, becoming arcuate when exserted. They are more or less equal, slender, uniform, rather blunt and appear to be not quite one-twelfth as wide as the body, and one and one-half to one and three-fourths times as long as the anal body diameter. They are cephalated by constriction and then slight expansion. They are simple and their proximal ends appear to lie somewhat dorsad of the body axis. The ejaculatory duct is one-fourth, the vas deferens one-fourth, and each of the two testes two-thirds as wide as the body; these testes are large, wide and equally well developed, tapering near their ends. There is a very obscure accessory piece, somewhat straight or slightly arcuate, very slender and frail, lying parallel to the spicula; its applied part is about one-third as long as the spicula. This accessory piece ends nearly opposite the body axis. There are no supplementary organs and no special male papillæ. There were only two poor specimens, diatomivorous. The presence of two testes indicates the probability that this species should be placed in a separate new genus, *Diatomphila.* The change, however, should await the examination of better material.

Monhystera neglecta *n.sp.*

4. *M. neglecta* n.sp. $\frac{0.26}{0.55}\cdots\frac{5.}{1.5}\cdots\frac{7.9}{1.5}\cdots\frac{^{78}\text{-M}}{2.}\cdots\frac{94.4}{1.6} > 1.2\text{mm}$—The thin layers of the transparent naked cuticle are traversed by exceedingly fine transverse striæ. No caudal setæ have been seen. There are traces on the head of setæ about halfway back to the amphids, at a distance from the anterior extremity nearly equal to the corresponding diameter of the head. These setæ are about one-third to one-fourth as long as the corresponding portion of the head is wide, are spreading, slightly curved, and apparently nearly cylindrical; but their number remains unknown. There certainly are submedian setæ in this latitude, and it would seem safe to assume that there are either six or ten setæ in a circlet halfway back to the amphids, but the observations do not establish this. The neck becomes very faintly conoid anteriorly and ends in a rounded head not set off in any way. The head region from the amphids on, however, in the single balsam specimen examined, is narrower than the portion of the neck immediately behind, and the very anterior cephalic portion is almost cylindroid. Whether this is due to shrinkage and the fact that the specimen is viewed only dorso-ventrally remains to be determined. Through the narrow open vestibule, which is less than one-fourth as wide as the front of the head, the obconoid pharynx is entered; the pharynx is small and obscure for a *Monhystera.* There are no distinct indications of overlapping, thin, transparent, membranous lips, such as are often to be seen in *Monhystera.* The round, external amphids, whose anterior borders are located at

*Dr. Albert Mann has identified the diatoms as being chiefly *Navicula cancellata* Donk , *N. aspera* var *antarctica* Perag., *N. gracilia* var *antarctica* Perag., and perhaps one or two *Achnanthes antarctica* Perag.

a distance from the anterior extremity about equal to the corresponding diameter of the neck, are about three-fifths as wide as the corresponding part of the neck. They are reminiscent of a helix and have a definite broad central elevation which in face view appears as a fleck. They are flattish cavities, one-third to one-fourth as deep as they are wide, with a slightly elevated central portion. Just behind the amphids the œsophagus is about half as wide as the neck; opposite the circlet of cephalic setæ the œsophagus is two-thirds to three-fourths as wide as the corresponding portion of the head. The œsophagus, of course, is monhysteroid and simple. The specimen is such that very little can be said about the structure of the anus. The arcuate tail of the male is conoid to the conoid terminus, which is about one-fourth as wide as the base of the tail. The spinneret is conoid and, so far as observed, unarmed. The sub-equidiametral caudal glands are apparently of the structure normal for the genus and are located in the anterior fourth of the tail. The arcuate, somewhat uniform spicula, which at their widest part are one-fourth as wide as the corresponding portion of the body, are one and one-half to two times as long as the anal body diameter. They are rather strong and refractive but are hardly cephalated, and, when seen in profile, have about the same width through about two-thirds of their length; in the distal third they appear to taper to a blunt point. They are accompanied by an apparently double gubernacular piece which is rather slender and is rather closely approximated to the spicula along their distal halves.

MONHYSTERA SEPTENTRIONALIS *Cobb*, 1914.

5. *M. septentrionalis* Cobb. $\dfrac{0.3 \quad 9. \quad 16. \quad {}^{40}\!\!-\!58. \quad 87.}{0.8 \quad 1.8 \quad 2. \quad 2.5 \quad 1.8} \rightarrow 0.76\text{mm}$ — In addition to the original data, the following information has been derived from the Mawson specimens. The very thin layers of the transparent, naked cuticle are traversed by transverse striæ, all alike. The contour of the nema is plain. The very minute, simple, regular, conoid to cyathiform pharynx is about half as wide as the front of the head and seems about twice as deep as wide. There are straight elements behind the minute cyathiform cavity that at least simulate a cylindroid or prismoid pharynx about two to three times as long as the front of the head is wide; somewhat the same has been seen in some of the Shackleton specimens of *M. septentrionalis*. In dorso-ventral view, the circular amphids are shown to be depressions,—slightly oblique backward. The anterior part of the intestine, for a distance equal to one body width, is set off behind also by a constriction, distinct though rather shallow. The rather straight, conoid tail becomes cylindroid in the posterior fourth, where it is one-sixth as wide as at the anus. The uterus is straight and presents no posterior rudiment.

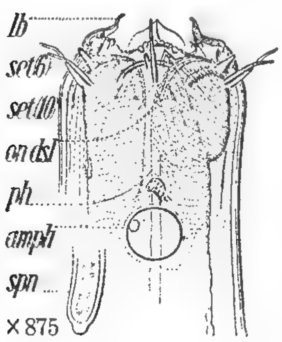
$\dfrac{0.3 \quad 10. \quad 17. \quad {}^{54}\!-\!\text{M} \quad 86.4}{0.8 \quad 2.2 \quad 2.5 \quad 2.5 \quad 1.8} \rightarrow 0.74\text{mm}$ —The tail of the male is conoid then cylindroid in the final fourth where it is about as wide as the spicula. The simple, non-cephalated, arcuate, slender, uniform, subacute or rather blunt, colorless

spicula, which at their widest part are about one-sixth as wide as the corresponding portion of the nema, are located very close together and are two to two and one-half times as long as the anal body diameter. The proximal ends are curved a little ventrad. There is one arcuate, very slender and frail accessory piece, about one-third as long as the spicula and lying parallel to them; this presents no backward apophysis, but is sometimes pulled away from the spicula. No preanal ventral supplementary organs have been seen. The ejaculatory duct is about two-fifths as wide as the corresponding portion of the body. In front of the spicula and attached to the proximal end is a cutinized "duplicate," three-fifths the size of the main part so that the whole is reminiscent of the double-jointed spicula of the genus *Xinema*. This additional part is frailer as well as smaller than the spicula. It is not clear that there are two of them.

Genus COBBIA *De Man*, 1907.

Cobbia mawsoni *n.sp.*

6. *C. mawsoni* n.sp. $\frac{0.6}{1.1}\cdots\frac{6.3}{1.2}\cdots\frac{14.}{1.5}\cdots\frac{48\text{–}65.}{1.6}\cdots\frac{92.8}{1.}$ >2.2mm —The somewhat thin layers of the transparent, naked cuticle are traversed by plain transverse striæ, all alike, and about two microns apart. The striæ are difficult of resolution and not further resolvable into secondary elements. The contour of the nema is plain or sometimes almost imperceptibly crenate, at any rate toward the extremities. The subtruncate head is almost imperceptibly set off by expansion, and bears six distinct, thin, longitudinally striated, fairly well developed lips, which, however, are not set off in any way at the base. There are at least a few scattered very slender cervical setæ—the longest of which, toward the head, are nearly as long as the radius of the neck. The typical, conoid, subregular, shallow pharynx is of moderate size, about three-fourths as wide as the head, and about as deep as wide. There is a small, conical, dorsal onchium, with a corresponding alteration in the musculature of the pharynx as shown in the illustration. There is a somewhat irregularly shaped granular nucleus just in front of each amphid, that stains strongly in acid carmine after mercuric chloride. The cylindroid œsophagus, which at the nerve-ring is two-thirds, and finally about three-fourths as wide as the corresponding portion of the body, presents a fairly distinct lining. It may be that there is a conoid cardia. The thick-walled intestine, which becomes at once three-fourths as wide as the body, presents a faint lumen; it is made up of cells of such size that about six would be presented in each cross section. The lining of the intestine is refractive and appears somewhat zigzag. The rectum,

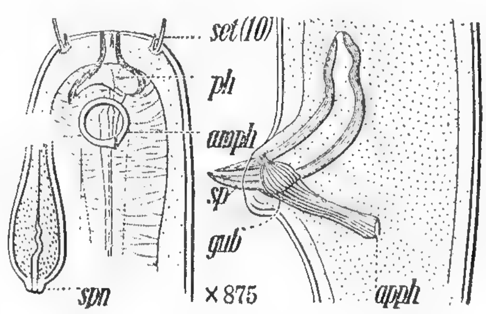


which presents a cutinized lining, passes inward and forward from the somewhat elevated anus a distance one and one-fourth times as great as the anal body diameter. The cells of the intestine contain small, brownish, somewhat uniform granules; these are numerous and give rise to a faint tessellated effect. The conoid subarcuate tail ends in an unarmed, blunt, conoid spinneret about one-sixth as wide as the base of the tail. The more or less ellipsoidal caudal glands form a close tandem in the anterior third of the tail. No caudal setæ were seen. Nothing is known concerning the renette. While the female sexual organ is of the type common to the genus, it has not been distinctly seen. The body diameter probably diminishes a little just behind the vulva, which is somewhat conspicuous. The blind end of the ovary lies two body widths behind the cardia. A poor specimen only, diatomivorous. Pending further investigation, the only course seems to be to refer this specimen to de Man's genus *Cobbia.*

Genus METALINHOMŒUS *De Man,* 1907.

METALINHOMŒUS MERIDIONALIS *n.sp.*

7. *M. meridionalis* n.sp. $\dfrac{0.4 \quad 3.0 \quad 6.2 \quad 18\text{-}51.\text{-}21 \quad 94.5}{0.9 \quad 1.2 \quad 1.2 \quad 1.5 \quad 1.}$ ♂ 2.5mm.—The rather thick layers of the transparent, naked cuticle are traversed by exceedingly fine transverse striæ, all alike, very hard of resolution and not further resolvable into secondary elements. Of the ten cephalic setæ, at least the longer submedian ones are jointed. No subcephalic or cervical setæ have been seen. The mobile subdistinct lips are thick, and fairly well developed. They are folded over the small, more or less discoid pharynx, and are not set off by constriction. The simple, typical, wide-napiform pharynx is two-fifths as wide as the head and has a depth equal to three-fifths the radius of the head. The vestibule of the pharynx is narrow when the lips are closed, and is as long as the lips are deep. In some aspects of the fixed specimens there seems to be a forward projecting ridge in the pharynx, which in optical longitudinal section appears like an onchium. When seen dorso-ventrally, the amphids appear as depressions two-thirds as deep as wide, having a well-cutinized lining, the bottom part of which is somewhat rounded up in the center. The lining of the œsophagus is an indistinct feature and finds its main optical expression as a single refractive "line." Behind the pharynx the diameter of the œsophagus is three-fifths, at the nerve-ring also three-fifths, and finally three-fourths as wide as the corresponding portion of the neck. The thick-walled intestine, about four cells in girth, becomes at once three-fourths as wide as the body; it narrows somewhat



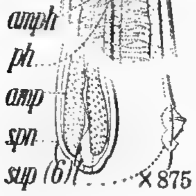
anteriorly so that the cardiac collum is only about two-fifths as wide as the base of the neck. From the anus, which is depressed, the cutinized rectum extends inward and forward a distance equal to the anal body diameter, or a little more. The cells of the intestine contain fine, rather conspicuous, brownish, more or less uniform granules which at the beginning are absent for a space equal to one body width. The granules are of such size that three would be required to span one of the amphids. The anterior part of the intestine for a distance equal to one body width appears rather "structureless" and almost without granules. The straight tail of the female tapers from in front of the anus, is at first conoid, then convex-conoid, then somewhat cylindroid in the posterior two-fifths, and presents a sub-apiculate, gradually swollen, rounded terminus armed with exceedingly fine short setæ. The transparent, rounded, symmetrical, blunt spinneret with exceedingly fine lateral wing-lines, is armed with almost invisible setæ. The caudal glands are situated behind the anus in the anterior half of the tail. The caudal setæ are few, scattered and inconspicuous. The renette was not seen. The tapering ovaries become quite slender, and contain ova arranged single file.

$\frac{0.5}{1.1}\quad\frac{4.4}{1.5}\quad\frac{6.6}{1.3}\quad\frac{^{60}\text{M}}{1.5}\quad\frac{94.}{1.5}$ ♂ 2.2mm—The two equal spicula are yellowish. There are two straight, rather slender, but strong, simple accessory pieces joined behind and surrounding the spicula near the anus. The very inconspicuous, equidistant, preanal, ventral supplementary organs extend to opposite the proximal part of the spicula, and are hardly more than mere innervations. The specimens are shrunken and too poor to permit of satisfactory observation concerning the internal male organs.

Genus PARASABATIERIA *De Man*, (1906) 1907.

PARASABATIERIA ANTARCTICA *n.sp.*

8. *P. antarctica* n.sp. $\frac{0.3}{0.6}\quad\frac{5.2}{1.5}\quad\frac{9.}{1.6}\quad\frac{^{31}\text{—}49.\text{—}^{25}}{2.1}\quad\frac{94.}{1.5}$ ♀ 2.5mm—The layers of the thin, transparent cuticle are traversed by exceedingly fine transverse striæ, further resolvable into very fine dots. The contour of the body is plain. No special subcephalic setæ have been seen. Scattered cervical setæ, minute, slender, and half as long as the cephalic, are present; there are similar scattered somatic setæ. The neck, which is convex-conoid in the anterior part and more or less cylindroid in the posterior part, ends in a subtruncate head set off by a broad, almost imperceptible constriction. The somewhat fixed lips are so well amalgamated that there can hardly be said to be any really distinct lips. The conoid pharynx is very obscure. It is small, simple, regular, shallow and unarmed. It is about half as wide as the lip region and half as deep as wide. Behind the pharynx the cylindroid



œsophagus,—which has an almost imperceptible swelling posteriorly,—is two-thirds to three-fourths, at the nerve-ring three-fifths, and finally two-thirds as wide as the corresponding portion of the neck. The lining of the œsophagus is subdistinct. The intestine becomes at once three-fourths as wide as the body. It presents a faint lumen and is made up of cells of such a size that probably only about five are present in each cross section. The cardiac collum is half as wide as the neck. The colorless granules of the intestinal cells are indistinct. From the continuous to somewhat depressed anus, the rectum extends inward and forward a distance equal to the anal body diameter. The straight tail of the female, which is conoid, then cylindroid in the posterior third, where it is one-sixth as wide as at the anus, tapers from the anus to a symmetrical terminus. The spinneret is armed with two pairs of slender, arcuate setæ; there are relatively large setæ also on the swollen part farther forward. The caudal glands are packed together in the anterior two-fifths of the tail, which they fill more than usually full. Each gland has a distinct duct. There are about sixteen slender, tapering, acute, caudal setæ—twelve ventrally submedian, postanal, and four ventrally submedian near the terminus. The lateral chords appear to occupy one-third the body width. The rather large ellipsoidal renette cell is one-third as wide as long. There is an apparent ampulla. The cells of the nerve-ring are obscure. From the rather conspicuous vulva, the more or less muscular vagina leads inward and at right angles to the ventral surface about half way across the body. The straight uterus contains smooth, thin-shelled, elongated eggs, one body width long, apparently deposited before segmentation begins. The long, slender, tapering ovaries contain about fifty ova each.

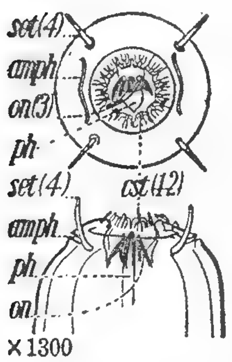
$\frac{0.3}{0.6}\cdots\frac{6.6}{1.6}\cdots\frac{9.5}{1.7}\cdots\frac{^{68}\text{—M—}}{1.8}\cdots\frac{94.}{1.7}\ 2.1\text{mm}$—The rather yellowish, strong, arcuate, noncephalated spicula are one and three-fourths times as long as the anal body diameter and at the widest part, one-fifth as wide as the corresponding portion of the body. Near the anus there is apparently a massive gubernaculum three-fifths as long as the anal body diameter bending back from the spicula and at right angles to them. The six preanal, somewhat mammiform, subequidistant, supplementary organs, which are considerably elevated and rather prominent, when the tail is arcuate, occupy a space equal to the tail length. There were two females and one male.

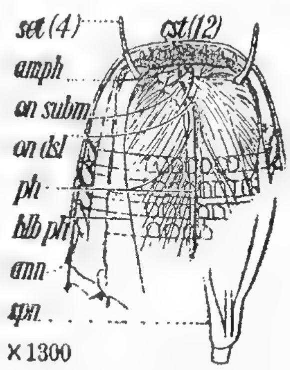
Genus CHROMADORA *Bastian*, 1865.

CHROMADORA DUBIA *n.sp.*

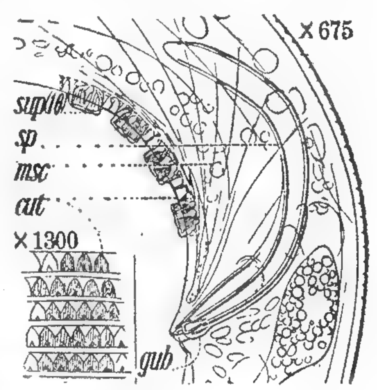
9. *C. dubia* n.sp. $\frac{1.2}{1.7}\text{--}\frac{8.1}{2.6}\text{--}\frac{13.}{3.}\text{---}\frac{^{18}47.^{10}}{4.3}\text{---}\frac{89.}{2.4}\ 1.3\text{mm}$—The thick layers of the transparent, naked body cuticle, occupying one-fifth the radius of the neck, and becoming thinner and ceasing opposite the base of the pharynx, are traversed by transverse striæ, all alike, with markings like those of *Euchromadora*,

becoming basketwork-like; on the back part of the neck they are easy of resolution, and further resolvable into distinct roundish dots, which become slightly elongate farther back, where they are fainter on the lateral fields and where there are also faint wings. The contour of the body is slightly crenate. There are no subcephalic or cervical setæ. The neck is cylindroid in the posterior part and somewhat conoid to convex-conoid in the anterior part. There are probably twelve minute, mobile lips, distinct at their acute tips. The small, typical, obpyramidal pharynx is as long as the radius of the head. There is one dorsal and two ventrally submedian teeth;—conoid, acute, slightly arcuate, nearly axial, and reaching in among the lips when these latter are closed. These onchia are about one-fourth as long as the head is wide. The dorsal one extends ventrad beyond the axis of the head and between the two subventral ones, so the three make a very compact group when the mouth is closed. The very inconspicuous, fleckless, outer amphids, are elongate transversely, symmetrical to two lines, and with closed peripheries; their anterior borders are removed hardly at all from the anterior extremity, *i.e.*, they lie between the cephalic setæ and, as seen in profile, appear very narrow when the lips are closed. The conoid, bulbless œsophagus is very slightly swollen anteriorly and again posteriorly. Behind the pharynx it is three-fifths, at the nerve-ring two-fifths, and finally two-thirds as wide as the corresponding portion of the neck. The thick-walled intestine, which is soon half as wide as the body, is four cells in girth near the cardiac region, and posteriorly twelve to fifteen cells in girth. Its cells contain minute, indistinct granules. It presents a faint lumen. From the depressed anus the rectum extends inward and forward a distance as great as the anal body diameter. The conoid tail which finally becomes convex-conoid, tapers from the anus to an unswollen, convex-conoid, very slightly unsymmetrical, unarmed, acute spinneret which is *not* striated. The apparently distinct, saccate caudal glands lie in the anterior fourth of the tail. There are no caudal setæ. The renette presents a somewhat elongated cell, one body width long and one-third as wide as long, situated from one to two body widths behind the neck. It has an ellipsoidal companion cell behind, which is one-fourth as long as the body is wide and half as wide as long. The lateral chords are about one-fourth as wide as the body. From the large, refractive, somewhat depressed, rather conspicuous vulva, the medium-sized vagina extends inward at right angles one-third the distance across the body. The uteri are straight. The broad, tapering ovaries reach two-thirds of the way back to the vulva, and each contains about twenty ova in single file, which are, however, arranged irregularly near the blind end. The excretory pore was not seen.





$\frac{1.}{1.5}\text{- - -}\frac{6.4}{2.1}\div\frac{14.}{2.4}\text{- - - - -}\frac{62\text{ M}}{4.1}\text{- - - - -}\frac{90.}{{}^{10}\searrow 2.0}\to 1.4\text{mm}$ —The strong colorless spicula are compound at their distal ends and are not cephalated. There is a faintly visible chord extending across the inner arc and they may be therefore wider than they appear to be. The arcuate, slender accessory piece, with rather strong frame, lies parallel and close to the spicula, and is about half as long as the spicula; there is no apophysis. The ten equidistant, preanal ventral supplementary organs, the last nearly opposite the middle of the spicula, are of the sort typical for *Chromadora* and occupy five body diameters. They occupy a distance equal to one and one-fourth times the tail length. The ejaculatory duct is one-third, and the wide cylindrical, then tapering testis, two-thirds as wide as the body.



Genus EUCHROMADORA *De Man*, 1886.

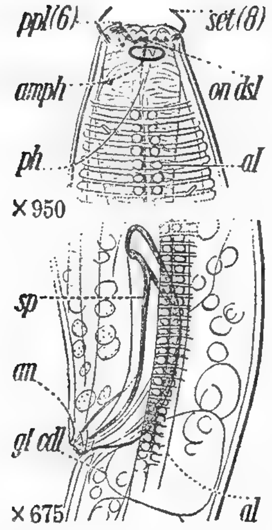
Euchromadora meridiana *Cobb.*

10. *E. meridiana* Cobb, 1914. A full description and formulæ of this species may be found in the "*Free-Living Nematodes of Shackleton Expedition.*" Sir Douglas Mawson's collections give rise to the following amendments and additions to the original description :—The obscure reversal of the striæ in the male takes place at about latitude 33 degrees. The strongly arcuate, sub-slender, rather strong and tapering spicula, somewhat cephalated at the tapered distal ends, are one and two-thirds times as long as the anal body diameter, and lie with their proximæ apparently very slightly ventrad of the body axis. There are two, more or less separate, duplex accessory pieces, one behind the spicula, the other, the telamon, in front. The two separate parts of the telamon, well separated, are somewhat like much reduced spicula. The posterior part consists of a broad, strong, double groove, one-fourth as long as the spicula, reinforced by three inward protruding arcuate elements, lying parallel to them; the longest one is median, and the other two, equal and shorter, are laterad from the median. This latter serves for the attachment of a muscle extending backward and ventrad in the tail. The ejaculatory duct is one-fifth, the vas deferens one-half as wide as the bodv.

Genus SPILOPHORA *Bastian*, 1865.

Spilophora aberrans *n sp*

11. *S. aberrans* n.sp. $\frac{1.}{1.4}\text{- - - -}\frac{9.}{3.1}\div\frac{15.}{3.4}\text{- - -}\frac{{}^{18}47.{}^{17}}{4.1}\text{- - - - - - - -}\frac{87.}{2.4}\to 1.2\text{mm}$ —The rather yellowish cuticle is traversed by transverse striæ, all more or less alike, easy of resolution, and materially altered on the lateral fields by two distinctly scalariform wing areas. Where relatively thickest, near the head end, the cuticle occupies nearly



one-third the radius of the head. The dots into which the striæ are resolvable are obscure and have been seen only near the extremities of the nema. The contour of the body is crenate near the head. There are no obvious subcephalic or cervical setæ. The neck, which on the whole is conoid but may be described as conoid in its posterior part and convex-conoid anteriorly, ends in a convex-conoid, somewhat rounded or subtruncate, continuous head. The twelve mobile, subdistinct, conoid, minute lips, closing over the pharynx, constitute a lip region whose contour is not set off. Notwithstanding their small size, the lips are rather readily distinguishable in the specimens examined; their apices lie close together and are forward pointing. The pharynx, which in reality probably extends backward to the region where the annules begin, is a simple, subregular, but apparently somewhat shallow, cyathiform, rather minute affair, approached through a short vestibule. It is armed with a small and forward-pointing dorsal tooth which stands in the midst of the lips. Being not very refractive, it is not easy to see. Apparently there are one or more inconspicuous submedian onchia. There is an almost imperceptible pharyngeal swelling, and an elongate cardiac swelling three-fourths as wide as the base of the neck. Behind the pharynx the œsophagus is one-half, at the nerve-ring two-fifths, just in front of the cardiac bulb two-fifths, and finally, three-fourths as wide as the corresponding portion of the neck. Beginning with a slight swelling, the intestine becomes almost at once half as wide as the body. The cells of the thick-walled intestine contain uniform colorless granules. The cardiac collum separating it from the œsophagus is one-third as wide as the base of the neck. From the depressed anus the rather prominent rectum, equal in length to the anal body diameter, leads inward and forward. The slightly arcuate conoid tail tapers from somewhat in front of the anus to the unarmed, more or less symmetrical, rather acute spinneret. The caudal glands form a close tandem in the anterior two-fifths of the tail; they are more or less broadly saccate. There are no caudal setæ. Nothing was discovered concerning the longitudinal chords. The ellipsoidal renette cell, two-thirds as wide as long, extends backward, and is accompanied by a faintly staining accessory cell half as large. The excretory pore is at the base of the lip region; no distinct ampulla was seen. The only thing known about the female sexual organs is that they are double and reflexed.

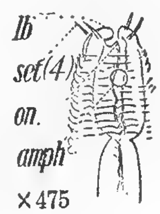
$\frac{1.}{1.5}$ - - - $\frac{9.5}{3.}$ $\frac{\text{♂}}{\text{♀}}$ $\frac{15.}{3.2}$ - - - $\frac{63\text{—M}}{4.}$ - - - $\frac{68.}{\text{10(?)} \quad 2.8}$ → 1.2mm —There appears to be only one gubernacular piece; it is arcuate, slender, rather frail and simple, and lies parallel to and close to the spicula, and is half as long as they. There are several minute preanal ventral supplementary organs, perhaps as many as ten; these are equidistant and appear to be coextensive with the rather distinct oblique copulatory muscles which occupy two to three tail-lengths. The posterior one of these supplementary organs is

opposite the middle of the spicula. The ejaculatory duct is one-fourth as wide as the body. The blind end of the narrow cylindroid testis is nearly as far behind the base of the neck as this latter is behind the anterior extremity. It is half as wide as the body. Numerous specimens of this species were found.

Genus MONOPOSTHIA *De Man*, 1889.

MONOPOSTHIA APICULATA *n.sp.*

12. *M. apiculata* n.sp. $\frac{3.}{\underline{3.7}} \cdot \frac{14.}{4.8} - \frac{23.}{\underline{5.6}} \cdots \frac{\text{Juv}}{5.} \cdot \cdot \frac{84.}{3.7} > 0.6\text{mm}$ —The layers of the thick, transparent cuticle are traversed by plain transverse striæ, all alike and readily resolvable with moderate powers, which cease halfway between the anterior border of the amphids and the anterior extremity. The contour of the body is serrate, the annules being retrorse posteriorly, and the reverse anteriorly. Opposite the middle of the pharyngeal bulb the cuticle is equal to one-fifth the radius—thinner elsewhere. There are twelve longitudinal wings to be counted near the cardia ; ten counted near the anus. These longitudinal wings appear as if composed of "fish-bone-like" elements, as is usual in *Monoposthia.* There are no subcephalic or cervical setæ. The more or less cylindroid neck, the anterior part of which, however, is somewhat convex-conoid, ends in a rounded, continuous, convex-conoid head. There are probably twelve distinct mobile, minute, conoid lips with inconspicuous papillæ—comprising a lip region almost imperceptibly set off by constriction. The long typical pharynx, which is entered through a narrow short vestibule, is cyathiform just behind the closed lips, then narrow. There is a single short dorsal onchium extending inward, then forward a little—its ventral face sub-axial. Behind the pharynx there is a distinct constriction. Here the œsophagus is one-fourth, at the nerve-ring one-third, in front of the cardiac bulb one-third, and finally five-sixths as wide as the corresponding portion of the neck. The elongated pharyngeal bulb, as long as the head is wide, is three-fifths as wide as the base of the head. The pineapple-shaped cardiac bulb is divided into three parts by transverse breaks in its masculature, the anterior part being small. The lining of the œsophagus is a distinct feature throughout. The thin-walled intestine soon becomes one-half as wide as the body and starts from a depression in the posterior surface of the cardiac bulb. It presents a faint lumen. The cardiac collum is one-third as wide as the neck. From the inconspicuous, almost continuous anus the cutinized rectum extends inward and forward a distance three-fourths as great as the anal body diameter. The tail, which is conoid, tapers from in front of the anus to a continuous blunt, rounded, unarmed, more or less unsymmetrical terminal part about one-half as wide as the basal part; this latter bears an unarmed, blunt, spinneret in the form of a large cylindrical apiculum slightly unsymmetrical at the very apex. The saccate caudal glands form a close tandem and are located behind and opposite to the anus in the anterior two-fifths of the tail. There are no caudal setæ. No renette has been seen.

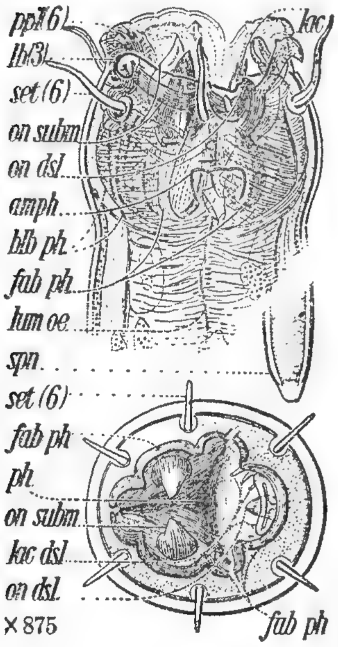


Genus HYPTIOLAIMUS.

HYPTIOLAIMUS CEPHALATUS *n.sp.*

13. *H. cephalatus* n.g.n.sp. $\frac{0.9}{1.3}$ $\frac{6.1}{1.8}$ $\frac{23.}{2.3}$ $\frac{?\text{— M Jar —}?}{2.2}$ $\frac{92.3}{1.6}$ 2.5mm

The thin layers of the transparent naked cuticle are traversed by exceedingly fine transverse striæ, resolvable with difficulty with the highest powers. These striæ do not seem to be further resolvable into secondary elements. There are no subcephalic, cervical or caudal setæ. The three large, rather thin, but muscular, faintly two-lobed lips are well developed, and each presents two low, conical, papillæ located, apparently, just inside the rather thick margin of the lips. It is assumed that the lips can be closed together so as to form a triquetrous mouth opening. In the single specimen seen the pharynx is open and the main features of its armature have been fairly well made out. It presents the peculiarity that the two ventrally submedian *equal* onchia are much more strongly developed than the dorsal one. Each submedian onchium springs from near the middle of the muscular bulbous pharynx and extends forward to an acute point. They are nearly twice as long as they are wide at the base and appear to be "hollow," after the manner of the onchia of *Oncholaimus.* The dorsal onchium is not more than half as large as those just described. When the pharynx is open,—the only position in which it has as yet been seen,—the apices of the submedian onchia are nearly on a level with the front of the lips. On each side of the small dorsal onchium there are three small seta-like appendages on the interior of the pharynx (*lac dsl* in Text Fig.), and there extends over the onchium, dorsad, a refractive flap-like pharyngeal element which lies in the wall of the pharynx parallel to the outer wall of the head. It is the well developed muscles of the pharynx that give rise to the somewhat bulbous appearance of the head,—at least the head is somewhat bulbous in the single specimen seen. It will be seen, therefore, that while the pharynx of this genus has a general resemblance to that of *Oncholaimus,* there are marked differences,—enough, no doubt, to justify the establishment of a separate genus for this species. The neck and œsophagus are like those of *Oncholaimus.* Except for the swelling at the front, the œsophagus maintains a rather uniform ratio in diameter to the corresponding portion of the neck,—namely, is about three-fifths as wide as the neck. Toward the very end it narrows somewhat so that the cardiac collum is only about half as wide as the base of the neck. There is a small conoid cardia,—an indistinct feature, about one-third as wide as the base of the neck. The intestine becomes at once two-thirds as wide as the body and is made up of cells of such a size that probably twenty are required to complete the circumference. The lateral chords are well developed, appear to be about one-fourth as wide as the body, and contain numerous nuclei of such a size that



five to six would be required, placed side by side, to span the width of the chord. The tail is conoid to the slightly convex-conoid, unarmed spinneret. However, it must be added that the terminus is of such a nature that the spinneret is left somewhat in doubt, especially as there are no clear indications in the tail of the presence of caudal glands; this, however, may be due to the fact that the specimen is not in a good state of preservation. It seems likely that the single specimen examined is a young male, and the indications are that there are two testes extending in opposite directions. The nerve-ring surrounds the œsophagus considerably in front of the middle. There are fairly clear indications in the structure of the œsophagus of the presence of œsophageal glands. Longitudinal striæ, due to the attachment of the musculature, are plainly seen throughout the greater portion of the body. Nothing was discovered concerning the renette. The labial papillæ are innervated. The outward parts of the amphids are believed to exist slightly in front of the base of the pharynx in the form of somewhat shield-like markings about one-fifth as wide as the base of the head. The lining of the œsophagus is a fairly distinct feature throughout its length. The intestine is thick-walled; its cells contain relatively large nuclei and granules of very small size that are not very numerous. Judging by the pharynx, this species may be a relative of *Oncholaimus*.

Genus AXONOLAIMUS *De Man*, 1889.

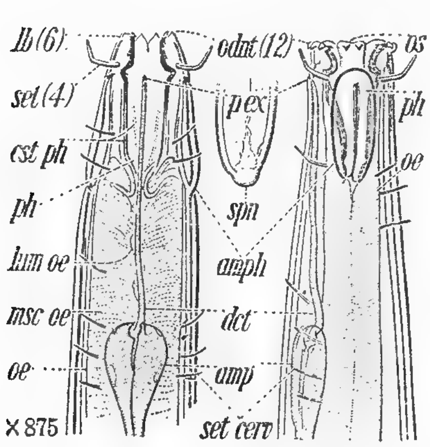
The following are characters in addition to those given on page 9, which are common to both the species of *Axonolaimus* here described.

The layers of thin cuticle are traversed by transverse striæ, difficult of resolution, all alike, and most easily seen near the tail. Subcephalic setæ are present. The six eversible lips when at rest are closed over a simple, pyramidal pharynx, the walls of which are strongly cutinized. The œsophagus is conoid. The walls of the intestine are thick, and its cells contain very fine granules. From the raised anus, the rectum extends inward and forward a distance equal to the anal body diameter. The tail tapers from the anus. The non-granular renette cell is as long as the body is wide. The spicula of the male are blunt and arcuate.

AXONOLAIMUS ANTARCTICUS *n.sp.*

14. *A. antarcticus* n.sp. $\frac{1.}{0.7}\cdots\frac{8.}{1.6}\cdots\frac{13.}{1.7}\cdots\frac{^{28}-54.-^{55}}{2.5}\cdots\frac{92.}{1.6}\cdot\!\!>2.0\text{mm}$—The layers of the transparent cuticle are traversed by fine transverse striæ. In addition to the cephalic setæ there is apparently also a set of four subcephalic setæ opposite the base of the pharynx. There are scattered cervical setæ. The faintly conoid neck ends in a subtruncate head which is continuous or set off by a broad, almost imperceptible, shallow constriction. The distinct, conoid, somewhat acute, well developed lips are mobile to such an extent that the lip region may become even revolute. The odontia are not so strongly developed as in some other *Axonolaimi*. The lips, even when

everted, do not show very distinct traces of odontia, at least in balsam specimens; but there are really six of them and each is two-parted,—that is, each odontium presents two separate, equal, subacute, arcuate-conoid, distal elements. The amphids are of typical axonolaimoid form. While they are undoubtedly referable to the helicoid type of amphid, they have the appearance of being bent double in front and the two subequal parts laid close together, so that the amphid appears as an elongated affair rounded at both ends, but particularly in front. The two branches are slightly different in length,—the dorsad slightly the longer; otherwise the amphid appears to be a quite



symmetrical affair. The œsophagus behind the pharynx is three-fourths, at the nerve-ring three-fourths, and finally two-thirds as wide as the corresponding portion of the neck. The lining of the œsophagus, which is a distinct feature throughout its length, finds its main optical expression as a single axial refractive element. The initial cells of the intestine, very close to the cardiac collum, stain more strongly than the remaining ones. The intestine becomes at once two-thirds as wide as the body; the lining of the lumen stains with acid carmine. The inconspicuous rectum extends inward and forward from the anus. Anal muscles have been distinctly seen. Granules of a yellowish color apparently exist in the cells of the intestine. The tail is convex-conoid, then cylindroid in the posterior fourth, where it is one-third to one-fourth as wide as at the anus; it ends in a somewhat swollen or rounded, unarmed, symmetrical spinneret. The three caudal glands, of saccate form, are located in a loose tandem in the anterior half of the tail. The ducts of the caudal glands are distinct and end in elongated ampullæ near the spinneret. The longitudinal chords are probably about one-third as wide as the body. The ellipsoidal renette cell, located three body-widths behind the base of the neck, is two-thirds as wide as long. The nerve-ring is accompanied by obscure nerve cells. The large, elevated, somewhat conspicuous vulva is half as wide as the body. From it the large cutinized vagina extends inward at right angles halfway across the body. The straight elongated uteri extend in opposite directions; they contain thin-shelled, smooth, elongated eggs about as long as the body is wide, which apparently are deposited before segmentation begins. The eggs have been seen one at a time in each uterus. As seen in the balsam specimen the shell of each egg presents a longitudinal mark, which, however, may be a wrinkle due to shrinkage. The proximal parts of the outstretched ovaries are broad, but taper to become one-fourth as wide as the body and contain about fifty ova each, arranged single file.

$\frac{0.9}{0.6} \cdots \frac{7.}{1.3} \cdots \frac{9.5}{1.5} \cdots \frac{{}^{70}\text{—M—}}{1.9} \cdots \frac{93.}{{}^{7(?)}\,1.8} \rangle 2.4\text{mm}$ —The stoutish, sub-uniform, yellowish spicula, which at their widest part, namely at the middle, are one-fifth as wide as the corresponding portion of the body, present two denticles at their tips. The spicula

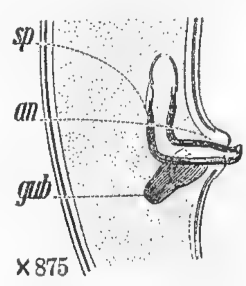
are so strongly arcuate as to appear somewhat semicircular, and are one and one-half times as long as the anal body diameter. They are strongly cephalated by expansion in such a fashion that their proximal ends lie opposite the body axis. In oblique view the cephalic ends of the spicula appear bifurcated and one and one-half to two times as wide as the shaft. There are two bent, stoutish, strong gubernacula joined together and presenting an apophysis two-fifths as long as the spicula,—blunt, half as long as the anal body diameter, and extending backward at almost an angle of ninety degrees; the free ends, close together, appear to lie somewhat ventrad of the body axis. There are seven preanal, ventral, supplementary organs and possibly more, occupying a distance about equal to three body diameters. They are subequidistant, inconspicuous,—hardly more than mere innervations,—and occupy a space two to three times the length of the spicula. There are about ten ventrally submedian setæ on the tail of the male. No oblique copulatory muscles have been observed. The ejaculatory duct is half as wide as the corresponding portion of the body and leads to the narrow tapering testes, and finally becomes about one-third as wide as the body. Two tail lengths in front of the anus of the male there is a longitudinal series of finely granular cells one-third as wide as the body, placed close one after the other. The first four are arranged in a moniliform manner, the remainder in pairs side by side. There are about twelve of these in all. These are probably the special glands found in male nemas, emptying into the cloaca.

Axonolaimus polaris *Cobb.*

15. *A. polaris* Cobb, 1914. $\frac{0.8}{0.6}\cdots\frac{4.4}{1.}\cdots\frac{6.2}{1.}\cdots\frac{^{18(?)}\text{–}50.\text{–}^{19(?)}}{1.1}\cdots\frac{97.}{.8} \rangle\ 2.4\text{mm}$ —

These specimens collected by Sir Douglas Mawson may very well be *Axonolaimus polaris* Cobb, and afford much additional information. There seem to be no important differences between them and the young specimen upon which *A. polaris* was based. The additional information derived from the present specimens is as follows: The apex of each lip is a convex-conoid refractive acute piece of cuticle two-thirds as long as the front of the head is wide. The walls of the pharynx are regular.

$\frac{0.7}{0.5}\cdots\frac{?}{?}\cdots\frac{6.}{1.}\cdots\frac{^{70}\text{–M–}}{1.1}\cdots\frac{97.}{1.} \rangle\ 2.4\text{mm}$ —In addition to the details given in the formulæ it may be said that the arcuate or L-shaped, tapering, non-cephalated spicula, which at their widest part are about one-sixth as wide as the corresponding portion of the body, are hardly longer than the anal body diameter. In the single male examined they are accompanied by a gubernacular piece about half as long as the spicula, extending inward and backward from the anal region at an angle of about forty-five degrees and ending bluntly nearly opposite the axis of the tail. The general appearance of these spicula is as that of



immature specimens, or as if something might possibly be missing. Nevertheless, the specimen otherwise appears to be in good condition, so it must be assumed, for the present at least, that details of the spicula are as given. No series of preanal, ventral, supplementary organs has been seen. The specimens are considerably shrunken and not very well preserved.

INDEX.

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Series C.—REPORTS IN COURSE OF PREPARATION.

ZOOLOGY.

FORAMINIFERA	F. Chapman, A.L.S., F.R.M.S., National Museum, Melbourne.
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